Towards High Performing Hospital Enterprise Architectures: elevating hospitals to lean enterprise thinking

by

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Submitted to the Engineering Systems Division
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY
at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
[June 2011]
May 2011

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Technology, Management, and Policy Track

Abstract

This research is motivated by the National Academy of Engineering and the Institute of Medicine's joint call for research in healthcare, promoting the application of principles, tools, and research from engineering disciplines, and complex systems in particular. In 2005, the US healthcare expenditure represented 16% of its GDP, with hospitals representing the largest source of expenditure, as is the case in the United Kingdom. Consequently, the strategies and operations developed and implemented by hospitals have a significant impact on healthcare. Today, it would be hard to find a hospital that is not implementing a Lean initiative or who isn't familiar with its concepts. However, more often than not, their approach has narrowly focused at a process level and inside individual service units like an emergency department. This research seeks to elevate traditionally narrow hospital definitions of lean and explore the broader concepts of lean enterprise principles and Enterprise Architecture (EA) while enhancing our knowledge of hospitals' socio-technical complexity and enriching an emerging EA Framework (EAF) developed at the Massachusetts Institute of Technology (MIT).

Following an extensive longitudinal multidisciplinary literature review, a number of expert interviews, and preliminary empirical findings, an exploratory inductive and deductive hybrid study was designed to collect and concurrently analyze both qualitative and quantitative empirical data from multiple hospital settings over two main phases:

- The first phase consisted of recorded interviews with the Chief Executive Officers of seven leading Massachusetts hospitals, who also provided sensitive internal strategy and operations documents. We explored how hospitals currently measure their hospital performance and how their explicit and implicit practices may be improved using lean enterprise principles.
- The second phase comprised two in-depth case studies of large leading multidisciplinary hospitals, one located in the US and other in the United Kingdom, and included a total of 13 embedded units of analysis. Multiple sources of evidence were collected including electronic medical records, 54 interviews, observation, and internal documents. Findings were categorized and sorted, as phenomena of interest consistently emerged from the data, and enriched both the EAF, and our understanding of hospitals' EA in particular.

In both in-depth hospital cases we found that their EA consisted of multiple internal architectural configurations, and in particular, those with an enriched understanding of EA had made decisions which had improved not only their local performance, but also enhanced their interactions with other service units upstream and downstream. Conversely, worse performing configurations demonstrated a limited understanding of their hospital's EA. We conclude that hospital performance can be improved through an enriched understanding of hospital EA. Furthermore, whilst considering all hospitals included in this study, we propose general and specific recommendations, as well as diagnostic questions, performance dimensions, and metrics, to assist senior hospital leaders in architecting and managing their enterprise.

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This thesis is dedicated in memory of my Grandfather *Manuel Gomes Varela Fradinho*, MD, who passed away in 2006, early-on my PhD, and became the major influence that steered my research towards healthcare. He was born in 1914, graduated in Medicine in 1938, and practiced General Surgery in Portuguese civilian hospitals and private clinics. Furthermore, he was an athlete, an author, an artist, a philosopher, and most importantly, he dedicated his life to the betterment of others.
Tenho saudades suas Pai Manel...

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Acknowledgments

In a process akin to that of *systems thinking*, this journey has benefitted from the breadth of the disciplines and roles covered by several key individuals, who freely shared their sage advice and support to various depths. However, only *holistically* can one begin to appreciate how vital each and every one of them was in making this dream a reality.

To begin with, I would like to thank my committee. Prof. Deborah Nightingale, my advisor and committee chair, for her positive and relentless support as we explored new concepts and nurtured symbiotic research collaborations with industry which were crucial in pursuing a worthwhile contribution. Prof. Joseph Sussman, for instilling upon me the rigor of the research process, and enlightening me with his insightful questions, and cross-domain analogies. Finally, Prof. Stuart Madnick, for his knowledge of information systems, and attention to research methods.

I would also like to thank those who proved to be instrumental at key stages of this work. Prof. Richard de Neufville, for treating me with "*the tea of wisdom*" and helping me when I needed it most. Dr. Kirkor Bozdogan, for raising my awareness and starting me on my in-depth longitudinal and multidisciplinary literature reviews which hopefully prevent the reinvention of the wheel and better inform our next step into the unknown. Similarly, Prof. Chris Magee, for pushing me to crystallize "*the knowledge bricks*" which I was building off of. Prof. Robin Ely, for patiently teaching an engineer the design of field research methods with the intent of studying complex systems phenomena. Prof. Richard Bohmer, for his teachings in aligning the nature and management of health care, and the understanding of hospital strategy and operations in particular. Dr. Mahender Singh, for his multidimensional research approach, and Friendship in supporting and steering me through the research process.

As part of the Lean Advancement Initiative (LAI) at MIT I was fortunate to have engaged in thoughtful and critical discussions with various research staff members and students. I would like to especially thank the following members of the LAI community: Prof. Earll Murman, Prof. John Carroll, Dr. Marc Haddad, Dr. Nicholas McKenna, Dr. Pedzisayi Makumbe, Dr. Sidharth Rupani, Dr. Daniel Livengood, Dr. Ricardo Valerdi, Dick Lewis, Dr. Donna Rhodes, Dr. Jayakanth Srinivasan, Phech Colatat, Jordan Peck, Thomas Shields, and Nicolene Hengen. A very big thank you is also due to Mark Prendergast who among other things branded me as "George with a J!". As part of the wider Engineering Systems Division (ESD) at MIT I would also like to thank Elizabeth Milnes, Erica Gralla, Dr. Chintan Vaishnav, Bob Rudin, Dr. Roberto Perez-Franco, and Prof. Yossi Sheffi.

As Teaching Assistant for four years in "*Integrating the Lean Enterprise*" I refined and deepened my understanding of lean, as I monitored multiple enterprises through class projects, and addressed the doubts and suggestions of some of the best and brightest graduate students that MIT has to offer. I would like to particularly thank the following students: Lt.Col. Dustin Ziegler, Lt. Col. Douglas Matty, Luis Maseda, Hrishikesh Ballal, Alissa Friedman, Nathan Perkins, Ellen Czaika, and Andrea Ippolito.

Prior to MIT I had the benefit of working and being mentored by highly experienced individuals who led me to dream the dream. These include in particular: Dr. Álvaro Duarte de Oliveira, Prof. Jimmie Browne, Prof. Bernd Hirsch, Prof. José Tribolet, Engº Luís Mira Amaral, Alejandro Gaffner, and Rafael Asensio.

Last but not least, I thank those who have somehow come to understand the *interdependencies* of my *enterprise architecture* and provided me with *stable* support all throughout my *continuous learning* and pursuit of *effectiveness* over *efficiency*. By the time the reader finishes reading Chapters 2 and 3 in particular, he'll understand the importance of the italicized terms, as did my Family and close Friends throughout this journey! Thank you Mom for your fresh perspective and unwavering support and enthusiasm (and congratulations to you too, as all three of your sons now hold doctorates!). I similarly thank my brother João, who also is the smartest and most sincere person I've ever met. I also thank my brother Manuel who always means well. Thank you Kathy and Ben for your warm welcome, for always making me feel home away from home, and showing me first hand so many wonderful things about this country. Thank you Kate for your ever lasting ability to put a positive spin on things, and for helping Mimi and I enjoy life beyond residency and PhD. Thank you Padre Taveira (*Quim*), Bruno, Zé, Marlene, Rita, Jean Baptiste, Ricardo, Filipa, Guida, Maria and Toninho; your Friendship knows no boundaries. Finally, I wish to thank my Wife Mimi, who accepted me for that which I am and saw me through the ups and downs of this journey, all the while offering me encouraging support and adding tremendous value to my research with her excellent engineering and medical training. May we together continue to weave our dream and build a better future for our unborn Son and those who need it most.

I am grateful to the organizations that provided financial support for this research, as well as those hospitals that provided extensive access to their enterprise:

Undisclosed hospital respondents

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List of Acronyms

AHA	American Hospital Association
BPR	Business Process Re-engineering
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CHF	Congestive Heart Failure
CMO	Chief Medical Officer
CMS	Centers for Medicare and Medicaid Services
COO	Chief Operations Officer
DRG	Diagnostic Related Group
EA	Enterprise Architecture
EAF	Enterprise Architecture Framework
ED	Emergency Department
EKG	*Elektrokardiogramm*
EMR	Electronic Medical Record
FFS	Fee For Service
GDP	Gross Domestic Product
GIM	General Internal Medicine
HDU	High Dependency Unit
HMO	Health Maintenance Organization
HMS	Harvard Medical School
ICU	Intensive Care Unit
IHI	Institute for Healthcare Improvement
IOM	Institute of Medicine
IT	Information Technology
JCAHO	Joint Commission on Accreditation of Healthcare Organizations
LAI	Lean Advancement Initiative
LOS	(Patient) Length Of Stay
MIT	Massachusetts Institute of Technology
NAE	National Academy of Engineering
NHS	(UK) National Health System
NP	Nurse Practitioner
NREAF	Nightingale and Rhodes Enterprise Architecture Framework
OECD	Organization for Economic Cooperation and Development
ORs	Operating Rooms
ORISG	Operating Room Inpatient Service Units Group
ORMB	Operating Room Management Board
P4P	Pay for Performance
PCP	Primary Care Physician
RN	Registered Nurse
SCC	Surgery and Critical Care Division
US	United States of America
UK	United Kingdom
WHO	World Health Organization

1. Introduction

The United States (US) health care system is a critical system grappling with as much as 16% of the gross domestic product in its expenditures and unsatisfactory outcomes while undergoing considerable public scrutiny (Kaiser Foundation 2007). High ranking officials have both singled out the US healthcare system as the most expensive and among the least effective in the developed world (National_Academies 2006). In fact, the president of Johns Hopkins University was quoted: "*Simply stated, the US does not have a health care system*" (Eastman 2007) as he alluded to the highly fragmented nature and variation of billing, care provision, accountability, safety, etc, inherent in the delivery of care.

The key categories often referred to when assessing the performance of the health care system are access, quality, and cost. In terms of access, an estimated 15% of the US population is uninsured (Thorpe 2007), and as many as 75% of care providers practice alone or in groups of five or fewer (Blumenthal and Glaser 2007). As for quality, adults on average are said to only receive as little as 55% of the recommended care for many common conditions (McGlynn, Asch et al. 2003), and between 44,000 to 98,000 annual deaths are attributed to medical errors (Kohn, Corrigan et al. 2000). Finally, the US spends 16% of its GDP on health care expenditures, including 30 – 40% of US health care spending which is believed to be wasteful (Reid 2005), and the largest source of expenditure, namely over 30%, is hospital expenditures (Kaiser Foundation 2007). Similarly the United Kingdom's (UK) highest source of healthcare expenditures are hospital services and infrastructure (National Health System 2008). Consequently, the strategies and operations developed and implemented by hospitals have a significant effect on access, quality, and cost of care (Devers, Brewster et al. 2003).

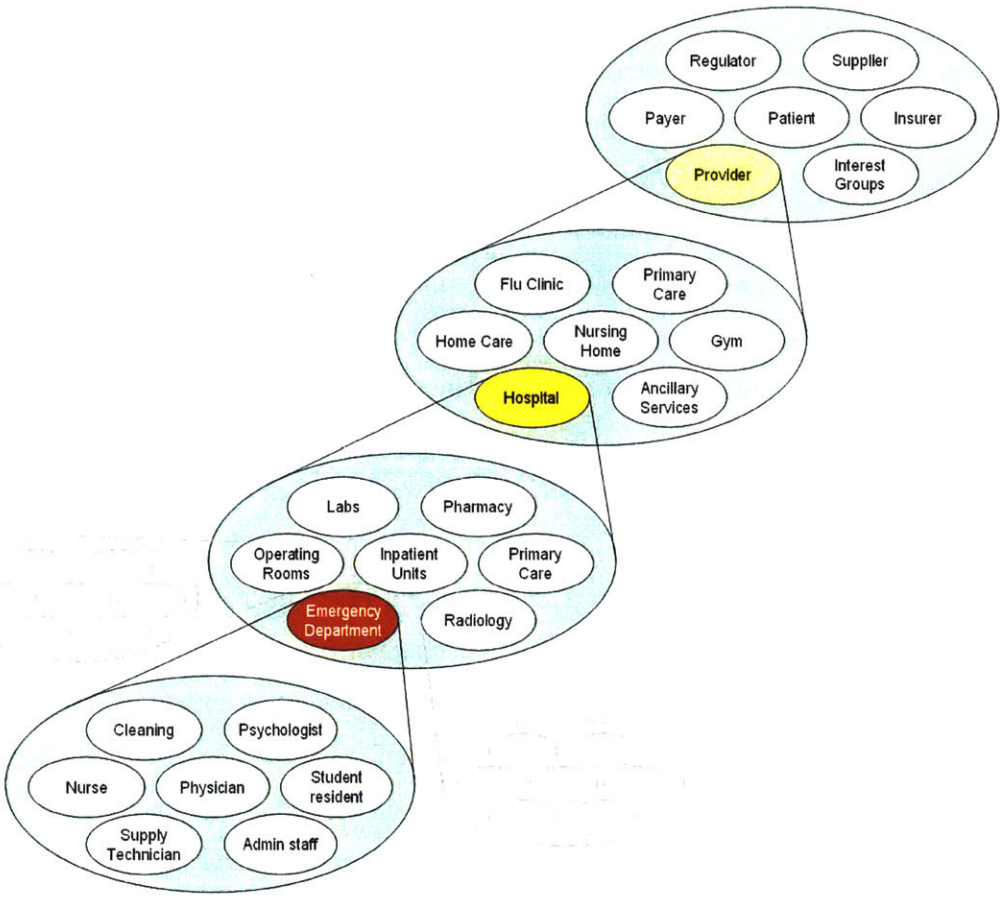

Figure 1-1: Multilevel stakeholder decomposition of a healthcare system (Oliveira, Nightingale et al. 2010)

The provision of medical care entails a complex and technically sophisticated enterprise that encompasses many different stakeholders (Robinson and Casalino 1996) which often times are not aligned with one another (see Figure 1-1). For instance, a characterization of the US health care system that has taken hold is that of it being a *cottage industry*, largely because of the proliferation of autonomous physicians practicing in small groups with limited oversight or coordination, who eschew standardization and deliver costly lower quality care (Swensen, Meyer et al. 2010). Additionally, the Institute of Medicine (IOM 2006) concluded in a high visibility report that current health care payment systems don't recognize or reward the coordination of care, and both preventive care and the treatment of chronic patients who move across various care settings are omitted. In essence, the current payment system has been considered one of the primary reasons for the US health care system's fragmentation, unreliability, and waste (Fisher 2006).

However, it is also important to consider fragmentation of the regulatory system whereby its effects, as expected of any complex socio-technical system, are such that changing even the smallest of features of legislation can have major, and sometimes unintended, impacts in the system's evolution (Butler 2010). Moreover, many agree the health care system presents a complex problem for which the solution is neither obvious nor likely to be painless (Chernew, Sabik et al. 2010). Specifically, "*all savings represent lost income for somebody, and affected stakeholders have successfully blocked, weakened, or circumvented past attempts at cost control*" (Hussey, Eibner et al. 2009).

Finally, US health care reform discussions have centered on insurance with standard benefit packages (Cortese and Smoldt 2007) or deep-in-the-weeds debates over technical details (Murray 2010), and little attention has been given to the care delivery itself thereby undermining the ability to improve the quality of care and slow the growth of spending (Rittenhouse, Shortell et al. 2009). However, the US is not alone in this approach and both the UK and Canada, among others, have been found to mostly pursue administrative fiscal interventions with little effect on the actual delivery of care (Glouberman and Mintzberg 2001). Interestingly, almost two decades ago the medical community had already urgently called for research on health care delivery organizations, suggesting that a relationship existed between organizational performance and organizational factors such as culture, coordination, and leadership (Flood 1994). As such, some state that once the existing reform debates are over, hospital managers are once again left with the task to design more effective and efficient approaches for delivering health care (Bohmer 2009). Therefore, hospitals constitute the focal unit of analysis in this research, whilst nonetheless including macro level contextual considerations (e.g. regulation, payment models, etc) and micro level of care delivery (e.g. emergency department, patient wards, etc).

1.1 Healthcare's elusive "Toyota Way"

In the 90s, faced with a similarly turbulent and challenging environment in the US automotive industry, researchers at the Massachusetts Institute of Technology (MIT) studied 52 assembly plants in 14 countries over a five year period to explore the significant performance gap between Japanese and Western automotive organizations (Womack, Jones et al. 1990). They coined the term *lean* when describing their finding that Japanese companies had a manufacturing system in place that built greater customer loyalty and strived for continuous quality improvement and doing so at a lower cost. Since then several academics and practitioners have studied Japanese companies in detail and developed recipes for lean success (e.g. "*The Toyota Way*" (Liker 2004)). As a result other industries began to take notice and wondered about finding their Toyota way, so much so, that today one would be hard pressed to find a hospital in the US which isn't aware of lean principles and considering the implementation of some kind of lean program (Liker and Morgan 2006).

Different experts vary in their enthusiasm when describing the success hospitals have had so far in their lean improvement efforts. Table 1-1 below features some of the experiences most consistently reported.

Table 1-1: Frequently reported lean hospital success cases

Reference	Case
(Kim, Spahlinger et al. 2006)	The Virginia Mason Medical Center decreased the number of ventilator-associated pneumonia from 34 cases with 5 deaths in 2002 to 4 cases with 1 death in 2004. They have also made space utilization improvements in their cancer center and are now able to see 57% more of patients in the same original space.
(Muto, Herbert et al. 2006)	A cohort of hospitals in Pittsburgh reduced the amount of central line associated blood stream infections by 68% on average
(Spear 2005)	A pre-surgery nursing unit at Western Pennsylvania Hospital in Pittsburgh reduced the time for registering patients from 12 to 60 minutes to only 3 minutes, and also reduced the number of unnecessary blood bank reports issued from 10 to 11 a day to 0 a day

Despite these successes other experts note that the US health care industry has "*No Toyotas*" given that generally the initiatives are limited in scope, duration, and impact (Coye 2001). Such an assessment is similar to those made of other industries where the

majority of lean and other improvement methodologies are reportedly unsuccessful (Corboy and O'Corrbui 1999; Repenning and Sterman 2001; Baker 2002).

Various authors have offered different views to explain this lack of generalized significant results. Some argue that one should not draw correlations from the automotive industry to other industries as there are fundamental differences in conditions (Adler and Cole 1993). Along those lines and in healthcare in particular, others have noted that there isn't any single customer to focus the improvement on and that instead many 'customer' communities exist and present a complex and fragmented scene, thereby hindering improvement initiatives (Young and McClean 2008). Others point out that even though organizational officials claim to implement lean, they are only implementing one or two of the elements (Nancy 1999), while solely focused at the process level (Bhasin and Burcher 2006) and often times within individual silos (Allen, Nightingale et al. 2004), instead of adopting a broader mindset beyond the 'shop floor' and across the whole enterprise (Murman, Allen et al. 2002).

Admittedly, the importance of considering multiple stakeholders as well as adopting a holistic approach that cuts across hospital silos, has began taking hold in the healthcare process improvement literature (Spear 2009). However, although the scope of hospital interventions are beginning to be enlarged, they are still insufficient if one wishes to strive for long term sustainability. With that in mind Liker and Morgan (2006) argue that one needs "*a true systems approach that effectively integrates people, processes, and technology* [and that what makes Toyota work] *is that all the pieces fit together and support each other.*" Moreover, Donald Berwick, former chief executive officer of the Institute for Healthcare Improvement (IHI), and recently appointed head of the Centers for Medicare and Medicaid, emphasized that the problem of healthcare redesign becomes increasingly "*harder and the evidence weaker as one moves from the microsystem to the organization*" [1] (Berwick 2002).

[1] The microsystem refers to the care given at service unit level (e.g. emergency department), whereas the organization is the care provider facility (e.g. hospital) that supports one or more microsystems.

1.2 Motivation

The overarching motivation for this research is to respond to the National Academy of Engineering and the Institute of Medicine's joint call to promote the application of "*principles, tools, and research from engineering disciplines associated with the analysis, design, and control of complex systems*" (Reid 2005). However, we do so with an understanding that the adoption of isolated organizational factors and/or principles don't automatically translate themselves in better hospital outcomes (Flood 1994). For instance, under pressure to deliver concrete and actionable operational effectiveness, managers have adopted a *best practice* mentality and sought the advice of business publications and consultants that often ignore the need to have a strategy (Porter 1996) thereby lacking an enterprise architecture perspective. Similarly, health care executives traditionally relegate "lean" and "Toyota" to a process level discussion focused on efficiency gains, which prevents them from "*doing the right things and doing things right*" (Drucker 1963). As such, in adopting a systems thinking approach we hope to elevate the traditionally narrow hospital definitions of lean health care and explore the broader concepts of lean enterprise principles and Enterprise Architecture (EA) while enhancing our knowledge of hospitals' socio-technical complexity and underlying performance.

To further understand our overarching motivation it is useful to refer to baseline definitions which in turn gave rise to additional research motivating factors:

- "*Lean enterprises are complex, highly integrated systems comprised of processes, products, organizations, and information, with multifaceted interdependencies and interrelationships across their boundaries*" (Nightingale 2002)
- "*A lean enterprise is an integrated entity that efficiently creates value for its multiple stakeholders by applying lean enterprise principles and practices*" (Murman, Allen et al. 2002)
- "[Enterprise Architecting is the application of] *holistic thinking to conceptually design, evaluate and select a preferred structure for a future state enterprise to realize its value proposition and desired behaviors*" (Nightingale and Rhodes 2007)

The coding of best practices (e.g. value stream mapping, multi-disciplinary teams, etc) and their organization into a framework has been considered an architectural design for high performance enterprises (Stanke 2006). The organization element is particularly important in that the individual principles aren't as relevant as their effective integration and application, and although some principles may sound elementary, their application throughout the enterprise is far from simple (Nightingale 2002). For instance, management and social scientists have produced an extensive amount of literature in understanding organizational behavior and designing organizations capable of deriving higher effectiveness. However, a key problem has been that different schools of thought have tended to focus on a single side of issues whilst using different logics and vocabularies that aren't shared beyond the individual school (Astley and Ven 1983).

In the late 1990s, MIT, established the Engineering Systems Division (ESD), as a new interdisciplinary unit within the School of Engineering with the proposal that new approaches, frameworks, and methodologies were needed to design large-scale complex systems that serve society's needs (Roos, de Neufville et al. 2004). One such framework is the Nightingale-Rhodes Enterprise Architecture Framework (NREAF) (Nightingale and Rhodes 2007), currently under development at MIT, which reflects preliminary generalized results based on several years of empirical studies (Rhodes, Ross et al. 2009).

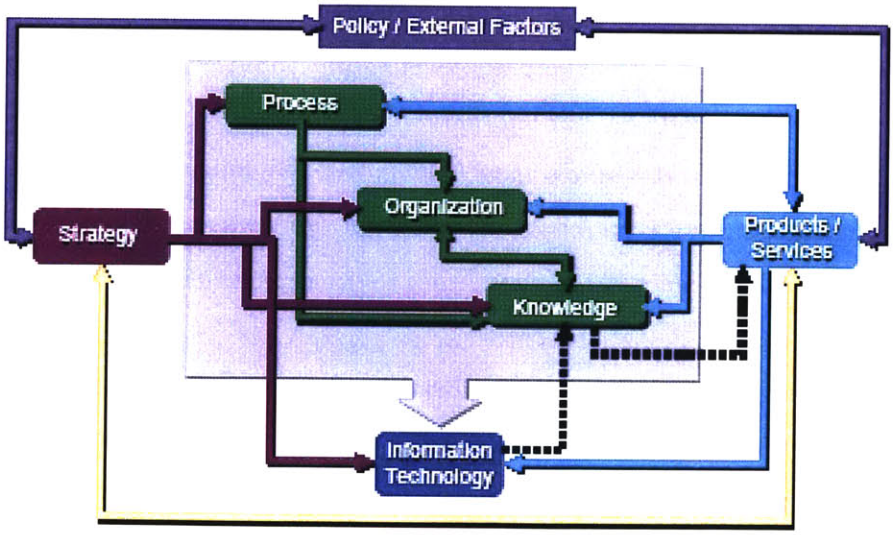

Figure 1-2: A Holistic Enterprise Architecture Framework (Nightingale and Rhodes 2007)

Enterprise Architecture (EA) is a concept derived from general systems theory whereby an organization is regarded as an open system comprising its context (e.g. external environment), its processes (e.g. organizational characteristics), and its outcomes (i.e. performance) (Katz and Kahn 1966).

Frameworks help define boundaries, specify dimensions or views and may also provide initial intuitions into the relationships amongst views (Rouse and Putterill 2003).To that effect the NREAF (Figure 1-2) adopts a holistic approach in the representation of enterprises thereby not focusing only on one or two individual elements and opting to study eight views (External factors/ Policy; Strategy; Process; Organization; Knowledge; Information Technology; Product; Service). Secondly the framework is neither domain specific nor information technology centric. Thirdly, the framework is holistic in the several views it considers, but equally holistic in that it proposes to study them in a congruent fashion so as to identify and study potential interactions amongst views.

In general frameworks have been found lacking if they are unable to develop beyond very high level descriptions of variables with unclear operational definitions (Pugh, Hickson et al. 1963), and neglect to build on well informed theory which allows to draw distinctions and relationships of conceptual significance (Miller 1996). Contingency theorists in particular have often used words such as fit, congruence, and alignment, which in the absence of clear descriptive guidelines make it difficult to compare and operationalize their contributions (Venkatraman 1989). An important recommendation for framework development has been that researchers employ commonly accepted measures of organizational constructs so as to allow for cumulative knowledge building (Rajagopalan and Spreitzer 1997). The NREAF is in its nascent phase of development (Nightingale 2009) and accordingly the second main motivation in this research is to leverage the NREAF[2] while conducting exploratory research at multiple leading hospitals, and iteratively theoretically enriching it with constructs from different bodies of literature pertaining to the various EA views. Additionally, rich empirical holistic EA descriptions

[2] Several alternative enterprise architecture frameworks will be examined in detail in Chapter 3 and compared and contrasted with MIT'S NREAF, and we will describe strengths and limitations of each.

that capture EA view interactions are also needed, so as to further enrich our understanding of EA.

A final motivation of this research resulted from the adopted inductive – deductive cycle research approach, whereby research questions were continuously refined so as to reflect our gradual increased understanding of EA, and hospital enterprises in particular. Specifically, at a more fundamental level, the notion of hospital improvement and leading status implied a baseline understanding of hospital performance, which shouldn't be dependent on any individual organization's perspective and/or mission. Such is consistent with a group of health care experts, charged with setting a research agenda aimed at improving the US health care system, who defined as their highest research priority the understanding and improvement of hospital performance measurement and the identification of key organizational characteristics from high-performing hospitals (Fernandopulle, Ferris et al. 2003). The application of lean enterprise principles, including among others an appreciation for the values of multiple stakeholders and an organizational end-to-end view (i.e. beyond any individual hospital department and/or service) will contribute with further insight into the characterization of high-performing hospitals.

1.3 Contextualizing Hospital Enterprises

As previously referenced, today one would be hard pressed to find a hospital in the US which isn't considering the implementation of lean. Equally frequent are the concerns of many health care practitioners who say that "*our hospital isn't like a Toyota assembly line!*" However, before hastily categorizing such statements as organizational resistance to change, it is useful to briefly elaborate on some of the reasoning behind them and how it in turn may affect our investigation of hospital performance and hospital enterprise architecture.

The automotive industry is a mass production assembly-line environment where each vehicle is built from thousands of parts that result from tightly connected processes which upon failing may have a large visible effect (i.e. line stops) or may go unnoticed and

generate future problems (e.g. product recall issued). Mass production is made possible because a production sequence is defined for every day, where the cycle time for each vehicle is calculated precisely according to the vehicle's specifications known ahead of time (Sugimori, Kusunoki et al. 1977). Moreover, highly standardized processes allow to determine the flow of resources from the time the raw materials enter a manufacturing facility to the end of the assembly process (Morse, Gordon et al. 1974). In contrast, hospitals are said to be neither able to predict their capacity requirements (Kellogg and Nie 1995) nor to standardize their inputs since every patient is unique and therefore a range of variation is present even in the most common procedures (Carroll and Edmondson 2002). Furthermore, health care practitioners not only exercise a significant degree of independence (i.e. a machine doesn't tell them what to do) (Drucker 1992) but also require key social skills to explain treatments to patients (Donabedian 1966) while keeping track of the continuous explosion of medical knowledge and technology (Swensen, Meyer et al. 2010). Understandably, hospitals are considered to be among the most complex organizations in modern society (Longest 1974).

A key distinction of hospital enterprises is said to be that a service is being delivered as opposed to a product being manufactured (Douglas and Ryman 2003). Emphasizing this distinction several researchers have considered inadequate and restrictive the direct application of manufacturing theories and techniques to the realm of services (Thomas 1978; Anderson, Cleveland et al. 1989; Kellogg and Nie 1995). Tien (2008) offers a baseline distinction between services and manufactured goods, as follows: services are co-produced, heterogeneous in their production, physically intangible, perishable if not consumed during production or by a certain time, customizable, focused in meeting customer expectations; manufactured goods are pre-produced, standardized in their production and use, physically tangible, can be built to inventory if not consumed, focused on reliability, and recyclable.

Evidently comparisons of products versus services rely on one or more dimensions, and tend to arrive at a continuum with considerable overlap over the two (Solomon, Surprenant et al. 1985). In hospitals for instance there are elements of both products and

services, when we consider that standardized surgical kits are assembled onsite ahead of time (i.e. product with standard steps followed with no deviation), or when blood/tissue sample is drawn from a patient and sent to the hospital's lab for analysis (i.e. service with standardized steps and minor deviation), or finally when a patient is receiving care (i.e. service which ideally follows evidence based medicine and involves considerable patient interaction which contributes to variability). Recently scholars have noted that hospitals have narrowly focused on process oriented lean tools, which amid less repetitive tasks and work of intangible nature, aren't of straightforward application (Liker and Morgan 2006). As such, these authors argue that lean should be regarded as "*a true systems approach that effectively integrates people, processes, and technology*" (Liker and Morgan 2006) which is true for both service and/or product enterprises (Nightingale 2009)[3].

1.4 An Interdisciplinary Approach

Research in the area of organizational design and performance is commonly regarded more as an art or craft in that one has to learn by trial and error given the absence of any process guidelines (Van de Ven and Ferry 1980). In the case of service organizations, a recent analysis from a system's perspective (Tien 2008) recommended that a multidisciplinary research approach is needed, including techniques from the social sciences, management, and engineering, so as to tackle the critical aspect of human complexity. Furthermore, systems thinking scholars have also recommended that empirical studies and case based research be used in furthering our understanding of contextual and workforce factors so as to derive more effective practices (Rhodes, Lamb et al. 2008). Accordingly, in this research we are not only leveraging and enriching MIT's emerging NREAF, but also our research approach is one that embodies different techniques in continuous iterative inductive – deductive cycles. To that effect, enquiry uses traditional analysis tools (e.g. value stream maps, patient flow statistical analysis, etc) as well as techniques from social sciences and management (e.g. grounded theory, case studies, etc), while guided by the emerging NREAF.

[3] The architectural implications stemming from the similarities and differences of services versus products are explored in detail in Chapter 3.

In their influential paper, Edmondson and McManus (2007) synthesize the concept of methodological fit as a key value attribute for high-quality field research in organizations. Field research is defined as systematic studies that require the collection of both qualitative and quantitative original data from real organizations. Methodological fit addresses the internal consistency among the different elements of a research project (i.e. research question; prior work; research design; and contribution to literature). The authors discuss at length the relationship amongst each element and alert to the danger that "*all researchers are vulnerable to preferring those hammers that we have learned to use so well*" (Edmondson and McManus 2007). With that in mind the authors assert that theory development falls across a continuum (i.e. mature, intermediate, and nascent) and recommend that research designs reflect the theoretical maturity of the research at hand. Mature theory includes well-developed constructs and models that have been consistently studied over time by various scholars, resulting in broad agreement and reaching cumulative knowledge gain. At the opposite side of the spectrum, nascent theory proposed tentative answers to novel questions of how and why, often only suggesting new connections among phenomena. Intermediate theory, as the name entails, lies between mature and nascent theory, and presents provisional explanations of phenomena by proposing relationships between established constructs and a new construct it may introduce.

As previously noted, MIT's emerging NREAF reflects preliminary generalized results based on several years of empirical studies and the general concept of EA is still in a nascent phase. Accordingly, our exploratory research was at first situated in the nascent phase of theory development but gradually entered an intermediate phase of theory development as we associated the phenomena of interest with constructs that are generally accepted in different literature domains (e.g. systems thinking; operations management; healthcare management; organization theory; etc). Examples of specific theories woven together in our research include, among others, coordination theory (Lawrence and Lorsh 1967), strategic choice (Child 1972), information processing theory (Galbraith 1974), knowledge-based theory (Grant 1996), information technology architecture (Ross, Beath et al. 1996), and enterprise architecture (Nightingale 2002).

The development of nascent theory traditionally employs an approach termed as *grounded theory* (Glaser and Strauss 1967) whereby instead of following a sequential process in which hypotheses are formed and data are collected and then analyzed, the researcher alternates and iterates the data analyses with the data collection process (Edmondson and McManus 2007). Over time intermediate theory development allows for pattern descriptions which suggest both variance theories (i.e. an increase of X leads to an increase of Y), and process theories (i.e. how a process unfolds). Ultimately, whereas mature theory favors quantitative data methods, and nascent theory favors qualitative data methods, intermediate theory favors a blend of both qualitative and quantitative data to further strengthen evidence triangulation (Jick 1979). To that effect over the course of our research we used the previously mentioned traditional analysis tools, as well as techniques from social sciences and management, which also included an extensive longitudinal literature review on the different organizational design and effectiveness theories mentioned, as these informed the analysis of the empirical data collected. [4]

1.5 Research Questions

In the course of our exploratory research an overarching motivating assumption emerged in that an enriched understanding of hospital enterprise architecture led to decisions that were more likely to improve hospital performance. The following are the four main research questions which were defined and gradually refined in the context of this research whilst addressing the above described research motivation:

- **RQ1**: How is hospital enterprise performance currently measured?
- **RQ2**: How could hospital enterprise performance measurement be improved using lean enterprise principles?
- **RQ3:** Can one create an enriched understanding of hospital enterprise architecture?
- **RQ4:** Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?

[4] Chapters 2 and 3 describe in detail our longitudinal literature review, including an analysis of lean enterprise principles and enterprise architecture frameworks, while Chapter 5 explains in-depth several of the considerations and decisions in designing and refining our research designs.

1.6 Thesis Outline

Given the undertaken continuous and iterative inductive and deductive research cycles, which included revisiting our initial hospital exploratory cases in the light of our enhanced literature knowledge and broader understanding from subsequent hospital cases, it would prove difficult to organize this thesis in such a way as to mimic the sequence of our methodological steps. Furthermore, different hospital samples were used to address different research questions, which in turn entailed different research methods, thus adding to the non-sequential nature of this research. Nonetheless, our writings on the compare and contrast analysis, within and across hospital cases, reflect how key phenomena emerged and underwent refinement, thereby offering further insight into our research process and sequence.

Chapters 2-4 have a dual role in the dissertation: on one hand they introduce the basics and nuances of enterprise performance measurement and the theoretical evolution of enterprise architecture and how it applies to healthcare. On the other hand these chapters form the knowledge-base on which the hospital empirical data collected is analyzed and subsequently structured in terms of generalized recommendations for hospital executives to improve their organizations.

With this in mind, in **Chapter 2** we examine different theoretical perspectives on the broader concept of organizational effectiveness as well as the inherent difficulty in adopting a multi-stakeholder approach versus a profit maximization approach. Subsequently we describe performance measurement practices and systems from a multidisciplinary perspective (e.g. operations research, product development, etc) on what are some of the most common pitfalls and best practices, including the learning stemming from LAI's ongoing research on lean enterprise principles and how it can improve hospital enterprise performance measurement. Finally, we introduce the key issue of defining health care quality and performance and how these relate to an individual hospital's mission in the context of their surrounding community and society at large. We also conduct a detailed analysis on multidisciplinary literature focused on hospital performance measurement and find that traditionally there has been a focus on

one or two performance dimensions, and although most recent publications advocate broader performance assessments, these are still at a conceptual level and lack empirical data.

Along the same lines, **Chapter 3** reviews additional bodies of literature applicable in our research, namely the literature on organizational design and systems thinking. Several organizational theorists have devoted considerable attention to the characterization of organizations and how the inherent relationships amongst design elements may affect an organization's effectiveness. Through our in-depth and longitudinal literature analysis we intend to first account for some of the early narrow thinking and then present more recent contributions that consider organizations in a more holistic way (i.e. gestalts). Such an evolution is particularly evident in the maturation of organizational design frameworks over time, of which we select ten of the most influential and compare and contrast them in terms of the organizational elements they consider important, as well as the relationships they study, and what they conceptualize as contributing to organizational effectiveness (if indeed such propositions are offered). MIT's emerging NREAF is confirmed as the most complete framework to inform our research. However, consistent with its nascent phase we also confirm the need for its theoretical enrichment with clear constructs and operational guidelines stemming from in-depth empirical study. Furthermore, in the context of this research, we discuss the importance of adopting an enterprise diagnostic mindset, which holds no pre-conceived notion of organizational element interactions, as opposed to an architecting mindset.

Chapter 4 is the final chapter in this introductory and knowledge-base sequence. The ailing US health care industry has often warranted a shared negative theme amongst media and academic circles which focus on distinct aspects of the problem, mostly concerning themselves with the institutional layer (e.g. regulation, payment models), and neglecting technical and organizational layers regarding the delivery of care. Chapter 4 frames the health care literature to offer a systems perspective and that of hospitals in particular. Furthermore, the chapter discusses key hospital characteristics and how these in turn need to be reflected in this thesis' research design.

Chapter 5 provides an overview of the research strategy rationale, the hospital samples used for each research question, and the different data collection and analytical methods used in each one of them. A review of pertinent literature is presented in support of the reasoning behind the hospital sampling, including the convenience stratified sample of Massachusetts hospitals. Additional methodology literature is reviewed to explain our research approach (e.g. crossing organizational levels of analysis to improve validity; using a hybrid research design; performing content analysis on interview transcripts; etc) and share our insights from planning our EA research.

In **Chapter 6** we first look closely at how hospital enterprise performance is currently measured, and we do so by leveraging the learning from the detailed literature review done in Chapter 2 and Chapter 4. A stratified sample of seven hospitals based in the state of Massachusetts was used in order to control for institutional layer effects. Two different research instruments were used and both of them were informed by the relevant literature described in Chapter 2. An 80 minute audio recorded semi-structured interview was administered onsite to the Chief Executive Officer of each hospital, followed by a 40 minute quantitative questionnaire enquiring on specific performance measurement preferences. Additional confidential documents (i.e. strategic and operational plans) were gathered on a case by case basis. The results of the quantitative instrument are interpreted in the context of the interview transcripts and publicly available data. In our analysis, we coincide with the literature in terms of its characterization of the health care system as fragmented, as well as in the description of narrow thinking induced upon hospitals by payers and regulators. However, we also establish that the sampled leading hospitals were exhibiting behaviors beyond those described in their explicit measurement practices as well as beyond those used to characterize them in the literature. Finally, we also identify areas for improvement and make 5 recommendations as to how hospitals can incorporate and benefit from lean enterprise principles. In doing so, we introduce a core concept of service architecture awareness. Additionally, we suggest diagnostic questions, performance dimensions, and key metrics, to further inform hospital leaders.

In **Chapters 7-8** we describe two in-depth exploratory studies of leading multispecialty hospitals, as we empirically and theoretically enrich MIT'S NREAF, and study whether an enriched understanding of hospital enterprise architecture can improve hospital performance. In these chapters, we follow a hybrid research design which consisted of qualitative and quantitative data collected from multiple levels of each organization, and assessed multiple dimensions of performance, using both subjective and objective data. One of the hospitals is based in the US and the other in the UK, and both have national and international recognition. These cases not only provided a unique opportunity of furthering our understanding of hospital complexity but also provided a lens beyond the traditional healthcare high level country benchmarks (e.g. average life expectancy; average healthcare spending per capita; etc) and yielded interesting insights such as the similarity of operational and strategic issues faced by hospital executives despite the fundamentally different institutional layer faced by each of the hospitals. Furthermore, we find that a hospital enterprise may consist of multiple internal architectural configurations which have different levels of understanding of the overall hospital's EA. Finally, we suggest that an enriched understanding of hospital enterprise architecture can inform decision making in successfully improving hospital performance.

Chapter 9 is the concluding chapter where we summarize our key findings, discuss how future research can build off from this work, and provide senior hospital leaders with additional specific recommendations on how to reconfigure their hospital enterprise architectures to derive improved hospital enterprise performance[5].

We now begin our journey with Chapter 2 where we discuss at length different theoretical viewpoints on organizational effectiveness and performance, and how lean enterprise principles are relevant for hospital management.

[5] Chapter 9's recommendations are in addition to the general recommendations presented in Chapter 6.

2. Enterprise Performance Measurement

The definition and measurement of performance at an enterprise level presents several challenges to practitioners and researchers alike. For instance, an entity may have its performance measured according to internally defined goals, which may or not be consistent with its mission statement and or strategic objectives, and in turn may or not be aligned with the evolving perspectives of influential stakeholders that reside beyond the organization's boundary, wherever it may be defined.

Measuring the performance of a hospital enterprise is particularly challenging given the varying definitions of healthcare (e.g. scope, value, human rights, etc) which are upheld by different stakeholders (e.g. patients, physicians, nurses, hospital board, regulators, employers, pharmaceuticals, medical devices, etc) and demanded of hospital leaders who in turn attempt to set the direction and induce desirable behavior for their organization to become and remain a high performing hospital. The complexity underlying this observation was evident upon conducting the empirical exploratory hospital cases (described in subsequent chapters) which prompted the elaboration of this chapter and associated research questions to inform the overall research presented in this thesis.

This chapter is heavily grounded in multiple bodies of literature and can be organized in three main parts, namely a multidisciplinary analysis of organizational performance research, a detailed analysis of lean enterprise systems' thinking and principles, and hospital enterprise performance measurement.

The first part begins with a multidisciplinary overview of organizational performance research, including how it has been the object of criticism over the years, and how it remains a central tenant of organizational theory and systems thinking. We then describe the major approaches and key assumptions that researchers have developed and refined when studying organizational performance (i.e. goal attainment; systems resource; multiple constituency; reputational and emergent). Next we explore in detail the key

issues of organizational performance assessments, including the existence of multiple stakeholders, multiple levels of analysis, and multiple dimensions of performance, followed by a description of published recommendations on how researchers can mitigate these issues.

The second part adopts the published recommendation (Quinn and Rohrbaugh 1981; Wagner and Schneider 1987) of leveraging the literature's convergence towards a theory of organizational performance, and to that effect in the context of this thesis, we examine in detail the systems thinking construct of lean enterprises. However we first begin by sharing a multidisciplinary view on the issues of best practice definitions, so that our own description of lean enterprise principles is as useful and supported as possible. We then examine the origins of lean, followed by a listing of popular lean best-practice lists, as well as a literature analysis on the reasoning behind failed implementations of lean. Finally we examine the emerging lean enterprise principles stemming from MIT's Lean Advancement Initiative (LAI) empirical research, which arguably represents the latest development in lean thinking, and conduct an in-depth literature analysis to bolster their theoretical underpinning.

The third part of this chapter addresses hospital enterprise performance measurement and consolidates our literature review in terms of the first two research questions posited in this thesis[6]. Leveraging the issues identified in the first part of this chapter we analyze in detail the challenges inherent in measuring hospital enterprise performance. Next we conduct a longitudinal and multidisciplinary literature review focused on hospital performance measurement and find that traditionally there has been a focus on one or two performance dimensions, and although most recent publications advocate broader performance assessments, these are still at a conceptual level and lack empirical data.

[6] Please refer to section 1.5.

2.1 Overview of Organizational Performance Research

The study of organizational performance has been considered of central importance to the theoretical development of different disciplines spanning over decades of research (see Table 2-1) and generating multiple definitions (see Table 2-2).

Table 2-1: Organizational performance central importance in different literatures

Reference	Source	Quote
(Goodman and Pennings 1977) page 2	Book	"it is difficult to conceive of a theory of organizations that does not include the construct of effectiveness"
(Van de Ven and Ferry 1980) page 9	Book	"Organizational performance is the ultimate criterion and starting point in an assessment of organizations"
(March and Sutton 1997)	Organization Science	"Explaining variation in performance or effectiveness is also one of the more enduring themes in the study of organizations."
(Forbes 1998)	Nonprofit and Voluntary Sector Quarterly	"Organizational effectiveness [...] is powerful in the sense that it represents a useful tool for critically evaluating and enhancing the work of organizations"
(Bourne, Mills et al. 2000)	International Journal of Operations and Production Management	"There is currently considerable interest in performance management"
(Evans 2004)	Journal of Operations Management	"The analysis of organizational performance is one of the more challenging criteria requirements for an organization to address"
(Folan and Browne 2005)	Computers in Industry	"performance is perceived as being an increasingly important field of research for both organizations and academics alike"

Table 2-2: Organizational performance definitions

Reference	Definition
(Pugh, Hickson et al. 1963)	An organization's success is defined in terms of it "reaching its stated goals [and] could be considered in the usual terms of profitability, productivity, adaptability, market standing, morale, and so on"
(Etzioni 1964)	Organization effectiveness is defined in terms of the degree to which a specific organization realizes its goals.
(Yuchtman and Seashore 1967)	Organization effectiveness is defined in terms of the organization's "bargaining position, as reflected in the ability of the organization, in either absolute or relative terms, to exploit its environment in the

	acquisition of scarce and valued resources"
(Van de Ven and Ferry 1980)	"performance is a value judgment on the results desired from an organization at different levels of analyses [and which] often change over time"
(Quinn and Rohrbaugh 1981)	Organizational effectiveness is a value-based judgment about the performance of an organization.
(Reimann 1982)	"the ultimate, long term criteria of organizational effectiveness are growth and survival. Moreover, the organization's competence in maintaining favorable energy flows with its environment is assumed to lead to this long term effectiveness."
(Quinn and Rohrbaugh 1983)	"Organizational effectiveness is not a concept. It is a socially constructed, abstract notion carried about in the heads of organizational theorists and researchers."
(Shrivastava 1983)	"Organizational effectiveness is thus determined by the quality of the knowledge base available to the organization for making the crucial strategic choices."
(Lebas 1995)	Organizational performance is defined as the ability to deploy and manage well the components that lead to the timely attainment of the stated objectives within the constraints specific to the organization and its context.
(Neely, Gregory et al. 1995)	"organizations achieve their goals, that is they perform, by satisfying their customers with greater efficiency and effectiveness than their competitors"
(Porter 1996)	"Operational effectiveness means performing similar activities *better* than rivals perform them [and] includes but is not limited to efficiency"

Throughout the same period several authors have expressed their dissatisfaction towards research practices and the general principle of studying organizational performance.

In the late sixties authors noted that organizational effectiveness studies showed inconsistencies, mostly due to different conceptions of the "*organizational effectiveness*" construct, which made comparisons across studies difficult (Yuchtman and Seashore 1967). Whilst reviewing effectiveness studies done on institutions of higher education, Kim Cameron (Cameron 1978) made an early important contribution to the wider community in identifying specific reoccurring problems such as the existence of different constituencies with different value perspectives, the different levels of analysis applied (e.g. individual, group, organization), the applicability (e.g. organization specific versus universal truths), the timeline (e.g. static versus dynamic), and the overreliance on specific types of metrics (e.g. quantitative versus qualitative).

In the late seventies authors called for improved methodologies to measure organizational effectiveness given the predominance of single variable studies (Hitt and Middlemist 1979) and the persistent elusiveness of a widely shared definition of effectiveness (Quinn and Rohrbaugh 1981). Moreover, authors expressed frustration at attempting to define performance given that not many people agreed on what it meant (Lebas 1995) and, in doing so, induced variable results stemming from researchers' individual value perspectives which ignored trade-offs with other concepts that weren't selected (Quinn and Rohrbaugh 1983). Ultimately, given such difficulties, some authors considered fruitless the search for a universal theory of effectiveness and even called for a moratorium on empirical research on effectiveness (Kanter and Brinkerhoff 1981; Goodman, Atkin et al. 1983).

More recently authors have continued to recognize a prevalent strong interest in researching organizational performance, but also that a vast array of results have been published in different functional silos (Neely, Gregory et al. 1995; Marr and Schiuma 2003) which have produced duplicate and/or contradictory results (Folan and Browne 2005) and continued to generate controversy and confusion (Au 1996; Smith and Goddard 2002).

The listing of organizational performance definitions, together with the associated research issues mentioned previously, can be further explained in the context of a set of theoretical perspectives that have emerged over time.

2.2 Theoretical Perspectives on Organizational Performance

There are several major approaches that researchers have developed and refined when studying organizational performance.

The **goal attainment approach** is one where effectiveness is defined in terms of goal attainment or the degree to which an organization attains internally defined goals (Perrow 1961; Etzioni 1964). This approach presents several challenges in that the researcher

relies on statements made available by administrators, annual reports, or other types of written documents, which may be misleading should the source be distorting, omitting, or misrepresenting the real purpose of an organization (Katz and Kahn 1966). Additionally, goal attainment may be difficult to establish where organizations have multiple and/or intangible goals (Warner 1967) which further complicates any attempts to conduct comparative analysis across organizations (Molnar and Rogers 1976). Furthermore, this approach invariably assumes that organizations are capable of internally selecting adequate objectives which reflect their underlying performance. Such an assumption is prone to produce erroneous pictures of performance in that an acceptable performance may indeed exist hidden under inadequately selected goals that haven't been met (Folan, Browne et al. 2007). Conversely, an organization may be attaining its internally defined goals, but these don't necessarily reflect what is demanded by the organization's external environment, thus poor performance is present.

The **systems resource approach** focuses on the interaction between an organization and its environment, whereby effectiveness is determined by the organization's ability to acquire scarce and valued resources from the environment (Yuchtman and Seashore 1967). As such, the organizations that receive the greatest amount of resources from the environment are the ones considered to be the most effective. For instance, organizations are said to increase their effectiveness if they engage and exploit other organizations through joint projects (Aiken and Hage 1968). The systems resource approach includes by definition an open systems perspective when it recognizes that an organization's performance cannot be measured independently of its environment (Katz and Kahn 1966). An advantage of the systems resource approach over the goal approach is that the researcher no longer has "*to solve the problem of identifying the ultimate goals of complex organizations*" (Yuchtman and Seashore 1967).

The **multiple constituency approach** addresses a shortcoming of the goal and systems resource approaches which directly or indirectly consider an organization's owner or its top management as the most relevant constituency (Tsui 1990). Several variations of the multiple constituency approach exist (Zammuto 1984), but the common argument made

is that several other constituencies may be as relevant or even more important for an organization, and that its effectiveness may depend on satisfying one or more of those constituencies. Mitchell et al (Mitchell, Agle et al. 1997) provide a valuable and extensive literature review on identifying and prioritizing amongst the multiple stakeholders within as well as beyond the boundaries of an organization. The following are illustrative quotes from two early influential authors cited in Mitchell et al: "*[stakeholders] are depending on the firm in order to achieve their personal goals and on whom the firm is depending for its existence*" (Rhenman 1964); "*[stakeholders are] any group or individual who can affect or is affected by the achievement of the organization's objectives*" (Freeman 1984). Freeman offers a distinction between two categories of stakeholders whereby generic stakeholders are considered common to most organizations (e.g. customers, employees, managers, and owners) whereas specific stakeholders may be relevant to only specific organizations (e.g. unions, consumer advocates).

The **reputational approach** constitutes a specific stream of the multiple constituency approach where organizational effectiveness is measured according to the reported opinions of key individuals (e.g. clients, staff, service professionals) who are familiar with the organization under consideration (Jobson and Schneck 1982).

The **emergent approach** is yet another stream following the multiple constituency approach and it focuses on definitions of effectiveness which are created by the individual or organizational actors involved, and are specific to a particular context as well as capable of evolving so as to reflect stakeholder interactions (Forbes 1998; Dunn 2010).

2.3 *Operationalizing Organizational Performance Assessments*

So far in this chapter we have referred to key issues in operationalizing and studying the results of different approaches used in organizational performance assessments. What

follows is a more detailed description of these issues as well as published recommendations to guide researchers in their organizational performance studies.

2.3.1 Multiple stakeholders

The multiple constituency approach proposes that researchers need to take into account multiple stakeholders who reside within or beyond the boundaries of an organization. In the context of a hospital for instance, hospital administration may be particularly concerned with efficiency and financial performance, whereas patients may value access to care, quality, cost effectiveness, and satisfaction, and in turn physicians may seek better administrative service or financial support as their affiliated hospitals undergo internal changes or renegotiate contracts with insurance companies (Bazzoli, Dynan et al. 2004). Understandably, the value expectations of the multiple stakeholders involved may or not be aligned with one another (Lewin and Minton 1986), which poses a question to both researchers and practitioners alike as to how organizational performance should be operationalized.

A similar argument was discussed previously with regards to the goal attainment approach whereby an individual organization may have multiple goals and it isn't clear to begin with which goals are more relevant to assess performance. Some constituency theorists suggest that relevant constituencies "*can be derived logically from an analysis of the organization's business, the industry in which it operates, its production technology, and its external labor and legal environments*" (Tsui 1990). One influential author advocated a baseline value judgment of social responsibility where "*every organization must assume full responsibility for its impact on employees, the environment, customers, and whomever and whatever it touches*" (Drucker 1992). More broadly, other authors proposed that the multiple constituency perspective should be used as a general research frame (Wagner and Schneider 1987). Ultimately, Van de Ven and Ferry (Van de Ven and Ferry 1980) shared in their seminal work in measuring and assessing organizations that "*consensus [on effectiveness goals, criteria, and standards] may be an unrealistic euphemism to attempt to achieve*" (p. 9) and that the researcher and/or organization analyst should firstly identify and make explicit the unique and conflicting definitions of

performance and then make an explicit decision on whose value judgments to operationalize and measure.

2.3.2 Multiple levels of analysis

The development of the multiple-constituency approach together with open-systems thinking brought to bear important considerations in terms of the adoption of multiple levels of analyses when assessing organizational performance[7]. To begin with an organization is comprised of multiple internal (formal and informal) units which compete for both internal and external scarce resources (Thompson 1967; Pfeffer and Salancik 1978). As such the results from each unit's efforts need to be described in terms that are relevant to their work as opposed to being buried in high-level aggregated goals (Maskell 1991). For instance, global financial performance measures are considered too aggregate and far removed to provide guidance or feedback on the decisions of lower-level employees (Malina and Selto 2001). However, measuring the performance of individuals such as knowledge workers can be particularly difficult (Groysberg, Lee et al. 2008). Furthermore, in order to build a complete picture of an organization's performance one needs to combine both a macro and micro view (Grover, Jeong et al. 1996). Moreover, it has been suggested that an organization's success may well depend on the compatibility between the performance measures used at the different levels of the organization (Lockamy Iii and Spencer 1998).

2.3.3 Multiple dimensions of performance

More often than not the definition of a stakeholder's value expectation needs to be translated into multiple dimensions in order for it to be adequately evaluated (Rouse and Putterill 2003). Venkatraman and Ranujam (1986) provide a useful review of the strategy research literature with regards to business performance measurement, and in particular their Figure 2-1 situates the predominant scholarly conceptions on performance dimensions (Venkatraman and Ramanujam 1986).

[7] Chapter 5 will describe at length our research design's methodological considerations concerning the use of multiple levels of analyses

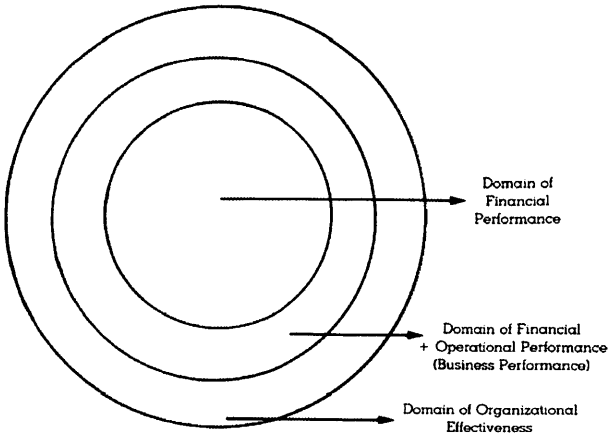

Figure 2-1: Common dimensions used in business performance measurement studies (adapted from (Venkatraman and Ramanujam 1986))

The narrowest and most dominant conception of organizational performance relies on simple outcome-based financial indicators (e.g. sales growth, earnings per share, return on investment, etc) that supposedly reflect the attainment of an organization's goals. A broader conceptualization of organizational performance includes the financial performance indicators as well as non-financial operational indicators (e.g. product quality, technology efficiency, marketing effectiveness, etc) that are thought to reflect key factors that might lead to financial performance. The outer ring and broadest concept is that of organizational effectiveness which includes the two previous concepts and recognizes the existence and importance of the multiple stakeholder values previously discussed (e.g. a value proposition beyond financials and/or a single entity). A similar conceptual framing can be observed from our review of other disciplines.

Traditional accounting performance measures relied exclusively on financial indicators for two primary reasons (Maskell 1991). First, organizations need a common denominator to allow for comparability across diverse product portfolios and multiple production facilities. The second reason embodied the preference for objective criteria and the assumption that an aggregated financial measure was capable of reflecting multiple changes and/or strategies being implemented simultaneously within an organization. Additionally more recent studies have noted that traditional financial measures of performance are most useful in conditions of greater certainty and low complexity (Malina and Selto 2001).

Over time as the conceptualization of organizational performance became broader so did the criticism of traditional performance measures drawn from accounting[8]. The use of financial measures is said to induce managers with myopic and short-term behavior that jeopardize long term strategy and potential performance (Banks and Wheelwright 1979). Long standing incumbents who mostly rely on financial measures are particularly prone to ignore important qualitative data such as customer satisfaction and miss warnings of incoming market shifts (Miller 1993). Similarly, organizations may be unable to accommodate knowledge-based strategies such as human capital enhancement given that these are inadequately recorded as current expenses (Malina and Selto 2001). Conversely, others persist with the opinion that organizations exist for the sole purpose of long term value maximization and that such benefits should be reported in financial terms (Jensen 2001). Finally, some authors warned that narrow financial reporting practices required by external agencies, were in fact also driving the way organizations internally managed themselves (Hayes and Abernathy 1980).

Having recognized the inherent limitations of adopting a one-dimensional view of organizational performance, authors began developing performance frameworks which allowed for a financial dimension as well as other key dimensions. For instance, organizational culture began undertaking a more central role in studies aimed at improving organizational effectiveness (Wilkins and Ouchi 1983). Three of the most well known performance measurement frameworks are the Balanced Scorecard (Kaplan and Norton 1993), the European Foundation for Quality Management Excellence Model, and the Malcolm Baldrige Criteria for Performance Excellence. Such frameworks are described as being able to provide a more balanced view of organizational performance and to that effect include non-financial, external, and future looking performance measures, together with the financial, internal, and past performance measures (Bourne, Mills et al. 2000). In a way one could argue that the development of performance frameworks followed the theoretical maturation process from the goal attainment and systems resource approaches towards the multiple-constituency approach whereby

[8] For a useful condensed literature review on the major inadequacies of traditional accounting measures please refer to Bhasin, S. (2008). "Lean and performance measurement." Journal of Manufacturing Technology Management **19**(5): 670.

different stakeholders can be, if needed, represented by entirely different performance dimensions. However, as with the difficulties introduced with increasing the number of stakeholders considered, the proliferation of frameworks has rendered impossible any attempt to develop a single framework for performance measurement (Rouse and Putterill 2003).

2.3.4 Towards a theory of organizational performance

Despite the strong interest in the organizational effectiveness construct the scientific community has struggled with attaining a widely shared definition of what it means and even though several multidimensional frameworks have addressed some of the key difficulties, these have nonetheless also introduced variants of the same problems they were trying to address. Moreover, a baseline variation persists in the selection of the previously described theoretical approaches (or some variation thereof) which different researchers adopt to guide their evaluations of organizational effectiveness (Campbell 1977; Reimann 1982). Furthermore, performance measurement frameworks or scorecards don't in themselves define the best strategy for an organization to adopt (Bhasin 2008) and aren't necessarily rooted on any particular management practice (Chang 2007).

Nonetheless consensus has been established insofar as organizational effectiveness isn't a singular tangible attribute to be agreed upon, but rather a theory about the performance of organizations (Quinn and Rohrbaugh 1981). For instance, the multiple-constituency perspective was proposed as a general research frame to guide studies in organizational performance (Wagner and Schneider 1987), as have been other broader concepts such as continuous improvement management philosophies (e.g. total quality management, lean, lean enterprises).

Drucker (1994) proposed that every organization has a "*theory of the business*" which embodies the assumptions that shape its behavior, determines what decisions to do or not to do, and establishes what constitute meaningful results. Also, the performance measurement literature generally converges on the recommendation that an organization's performance measurement criteria should match its strategy and vision

(Globerson 1985; Maskell 1991; Wisner and Fawcett 1991; Kaplan and Norton 1993; Bourne, Mills et al. 2000; Folan, Browne et al. 2007). However, in our literature review we also identified limitations inherent in evaluating performance using solely the criteria set forth by a particular organization (i.e. goal attainment perspective). Consequently, the literature recommends that researchers avoid situation specific performance criteria, and instead adopt a theory of organizational performance which includes general criteria that may be studied repeatedly from organization to organization, although requiring different operationalizations depending on each organization's context (Quinn and Rohrbaugh 1981). Hence, in the context of this research, becoming a lean hospital enterprise is proposed as a "*theory of the business*" which reflects general lean enterprise principles, and is assumed to enable a hospital to reach higher performance. This assumption is supported in our in-depth literature review presented in the next section where both traditional lean and the latest lean enterprise thinking are examined in detail.

Next we intend to analyze these best practices of organizational performance but before doing so it may be useful to remind ourselves of two observations made by influential scholars. The first one was drawn earlier and from the narrower theoretical construct of individual motivation, but provides relevant insight nonetheless: "*a dismal ratio of knowledge to speculation [exists and yet it doesn't dampen] the enthusiasm for new forms of snake oil that are constantly coming on the market, many of them with academic testimonials*" (Herzberg 1968). The second observation is more recent and was made in the context of organizational performance research: "*Even though almost everyone knows that the emperor has no clothes, few people talk about that fact, and many of the same people who note the emperor's nakedness nevertheless discuss the tailoring of his suits*" (March and Sutton 1997).

2.4 Lean Enterprise Principles

Drucker (1994) proposed that every organization has a theory of the business which embodies the assumptions that shape its behavior, determines what decisions to do or not to do, and establishes what constitute meaningful results. Similarly, Grant (1996) noted that such theories of the firm are predicated on initial premises which form the basis of propositions concerning a firm's structure, behavior, and performance. Moreover, a theory, or philosophy, provides an overall vision which encompasses various best practices that help guide an organization's redesign efforts (Glasgow, Goldstein et al. 2004; Reijers and Liman Mansar 2005). Notably, becoming a "*Lean Enterprise*" is a theory which has been increasingly recognized as an important strategy to attain critical strategic goals (Nightingale 2002).

Determining what constitutes a Lean Enterprise, or any theory of the business, may sound deceptively simple but it involves several years of empirical experimentation before reaching a clear, consistent, and valid theory for a given organization (Drucker 1994). Along those lines, leading enterprise scholars have recognized that they are currently capable "*at best [to] cite heuristics and emerging principles on how enterprises should be architected [so that they] can most effectively produce its desired outcome*" (Rhodes and Nightingale 2008). As such, in this section we first examine the general meaning of best practices and principles, as well as some of their potential issues and how to mitigate them. Our improved understanding of best practices and principles prompts us to examine the literature in terms of the origins of traditional lean and how it progressed towards the systems thinking approach of lean enterprises. To that effect we first examine the traditional definitions of lean including its baseline principles and tools as developed by Toyota. Additionally, we capture several lists of best practices suggested by different authors on how to attain higher performance. Next we provide evidence of common lean failures documented in the manufacturing literature. Finally we examine the emerging lean enterprise principles stemming from MIT's Lean Advancement Initiative empirical research, which arguably represents the latest development in lean thinking, and conduct an in-depth literature analysis to bolster their theoretical underpinning.

2.4.1 "*Best Practice*" definitions, issues, and recommendations

The term "*best-practice*" is akin to Taylor's management philosophy of finding the "*one best way*" whereby a research field may strive to integrate large bodies of evidence spanning multiple decades (Peters and Heron 1993) to enable a researcher (or practitioner) to pick the best or the most successful practices independent of an organization's particular context (Overman and Boyd 1994). When sifting through the literature one often finds the assertion that best practices have commonly produced bandwagon effects (Peters and Heron 1993; Abrahamson 1996; Benner and Tushman 2003) as organizations embrace the practices of highly visible companies in their given market (or indeed across markets) with incomplete but convincing enough results that may ultimately lead to ineffective or even harmful outcomes (Benner and Tushman 2003). As a result a recommendation was made that best practices be subject to more scholarly investigation (Bardach 1987).

Tasked with finding a common definition of best practice in the extant literature, Peter and Heron (1993) neither found one nor did they come across any explicit criteria used in identifying and/or determining best practices. As such, the same authors proposed that in order to establish powerful and useful best practices, these must not only be the product of expert opinion, but also have empirical support as well as some underpinning with existing literature on that practice or related practices. Expert opinion, or that of leaders in a given field, although useful is said to be insufficient as it only provides face validity and may give rise to different opinions reflecting different guesses or values whilst potentially supported by biased data. In some cases a value judgment precedes the need for empirical support as with social justice, civil rights, and social access as these don't depend on the power of a piece of evidence presented. Finally, the authors also note that just like practitioners shouldn't mistake expert opinion as proof, they equally shouldn't consider correlational evidence on its own as a cause-effect relationship.

Other recommendations concern the dissemination of best practices so that these aren't derived with a "*one best way*" in mind but rather with an awareness of prevailing conditions so that the proposed best practices may be adapted to each context (Reijers

and Liman Mansar 2005) and in essence following "*principles*" that provide meaning and direction (Bardach 1987). Similarly, Womack and Jones (1994) noted that principles regulating value stream behavior will necessarily vary with the nature of the product (or service) and the degree of familiarity amongst collaborating organizations. Yet another conditioning contextual factor may be the particular phase an organization is going through (e.g. start up vs. legacy) (Quinn and Cameron 1983) which may have a direct effect on the relevance of a best practice. Lastly it is important to note that although the operationalization of a principle may vary from one organizational context to the next, such does not inhibit comparisons across studies as the principles themselves can be studied repeatedly (Quinn and Rohrbaugh 1981).

With these recommendations in mind we next turn to the literature to examine the origins of traditional lean and how it progressed towards the systems thinking approach of lean enterprises.

2.4.2 The origins of lean

In the 90s, faced with a turbulent and challenging environment in the US automotive industry, researchers at the Massachusetts Institute of Technology (MIT) studied at length 52 assembly plants in 14 countries over a five year period to explore the significant performance gap between Japanese and Western automotive organizations (Womack, Jones et al. 1990). They coined the term *lean*[9] when describing their finding that Japanese companies had a manufacturing system in place that built greater customer loyalty and strived for continuous quality improvement and doing so at a lower cost. Several well referenced volumes have been published where the origins of lean are already described at length (Womack, Jones et al. 1990; Murman, Allen et al. 2002; Womack, Jones et al. 2003). Our purpose in this subsection is to provide a synthesis of the key lean principles and tools set forth by Toyota whilst referring to several publications including one of the earliest of its kind published by Toyota experts themselves (Sugimori, Kusunoki et al.

[9] The term was coined by John Krafcik who was an MIT research assistant at the International Motor Vehicle Program in the late 1980s and at the time of writing this thesis is the president and chief executive officer of Hyundai Motor America.

1977).

Jeffery Liker is an influential author who has studied and written extensively about the success of the Toyota automotive company. On one of the author's earlier writings Toyota's lean Production System (TPS) is described as "*a philosophy that when implemented reduces the time from customer order to delivery by eliminating sources of waste in the production flow*" (Liker 1997).

One of the earliest definitions of waste (or *muda* in Japanese) represented "*anything other than the minimum amount of equipment, materials, parts, and workers (working time) which are absolutely essential to production are merely surplus that only raises the cost*" (Sugimori, Kusunoki et al. 1977). Subsequent refinement specified that waste constituted any activity that added cost while not adding value as perceived by end-use customers (Ohno 1988) where the end-use customer was not necessarily the entity who paid for a product. Focusing on eliminating waste and adding value to customers became a common reference for engineers tasked with improving processes (Liker and Morgan 2006). There are seven types of waste most commonly referred to (Nightingale 2004), namely: over production; waiting; transporting; inappropriate processing; unnecessary inventory; excess motion; defects. Examples of these wastes include items that no one wants, costly processes which aren't needed, employees/goods being transported without any purpose, or people waiting to carry-out a downstream activity because an upstream activity has not completed on time.

The benefits most commonly attributed to lean implementations (Bicheno 2004; Liker 2004; Womack and Jones 2005) include shorter cycle/lead times, faster response times, less work in process, lower costs, higher quality, increased profits, and improved customer service.

The first lean principles to be singled out (in equal measure) by Toyota experts were just-in-time production (JIT) and respect for the human system (Sugimori, Kusunoki et al. 1977) and both were only focused at the process level. JIT was considered an especially

important factor as it only manufactured the necessary products, at the necessary time, and in the necessary quantity, which allowed for stock levels to be held at a minimum in order to hold processes together. In order for JIT to work the authors list three key requirements. Firstly, rather than a preceding process *pushing* its output onto the next process, the following process *pulls* the parts from the preceding process, thus allowing for processes to quickly attain accurate knowledge of timing and quantities required without the need of issuing lengthy production orders to each process. Secondly, each process produces only one piece at a time (i.e. small lot production), conveys one piece at a time, and needs to be standardized. Thirdly, production must be leveled (or *heijunka* in Japanese) so as to avoid either keeping preceding processes at peak capacity or building excessive inventory.

The respect for the human system consisted in allowing workers to "*display in full their capabilities through active participation in running and improving their own workshops*"[10] (Sugimori, Kusunoki et al. 1977). Moreover, it was understood that "*the only way to motivate the employee is to give him [or her] challenging work in which he [or she] can assume responsibility*" (Herzberg 1968). The full utilization of workers' capabilities was particularly present in three ways. Firstly, unnecessary movement and/or waiting of workers were eliminated by lessening supervision where possible and by training workers to operate multiple machines. Secondly, worker safety was a priority thus operations requiring hard physical and repetitive labor became mechanized and automated. Thirdly, workers were empowered to stop equipment whenever they detected an abnormal or defective part (i.e. called *jidoka* in Japanese). Jidoka prevented unnecessarily making faulty parts and readily identified a problem area that needed fixing.

The two lean principles taken together comprise Toyota's production control system (i.e. Kanban System) whereby workshops no longer needed to rely on a costly electronic computer capable of production scheduling and real time monitoring/adjustment of both the suppliers and assembly line (Sugimori, Kusunoki et al. 1977). However, in order for

[10] Please note that *workshop* in this context has the semantic connotation of a manufacturing cell where an employee works on a given activity

the Kanban System to work employees had to establish responsibility systems and engage in spontaneous continuous improvement activities (or *Kaizen* in Japanese).

While striving towards upholding its principles Toyota uses several lean tools which receive different levels of attention in the literature. Four lean tools that are frequently highlighted are visual control, five Ss, value stream maps, and the problem solving A3 report:

- Visual control requires that all work be easily visible and thus manageable by sight. As such, visual barriers should be removed whenever possible (e.g. closed cabinets, walls, etc). The absence of unnecessary visual barriers also enables easier access to resources (e.g. people, inventory). Furthermore, visual control may also use on wall displays with trend charts, schedules, and troubleshooting of known problems.
- Five S's is a lean tool that facilitates teamwork (Liker 2004) and helps organize a workplace (Emiliani and Stec 2005). The tool's name is derived from five Japanese words (i.e. *seiri, seiton, seiso, seiketsu* and *shitsuke*) which have been translated into English in different ways by different authors. One version is sort, stabilize, shine, standardize, and sustain (Liker 2004). The last 's' of sustainment requires that the previous four 's's be in place.
- Value stream maps (VSM) represent the key people, material, and information flows to deliver a product or service (Jimmerson, Weber et al. 2005) whereby each step is characterized as non-value added, value added, or non-value added but needed (Nightingale 2004).
- The Problem-Solving A3 Report fits in a single sheet of paper and includes descriptions of a problem (from the customer's perspective), of the current procedures (using a simplified VSM), of the specific root causes of the problem, of a desired target condition to eliminate the problem (using a simplified VSM), and an implementation plan with specific responsibilities and deadlines assigned to individuals. The use of a single sheet dictates that problems must be small and thus allow for rapid improvement.

2.4.3 Proliferation of best practices lists for organizational performance

The strong interest in the origins of lean gave rise to multiple lean best practices being submitted by different authors in their attempt to explain Toyota's higher performance. In general a trend exists whenever best practices are sought in that multiple differing lists of guidelines are submitted with "*obvious discrepancies [...] relative to the way in which practices are characterized and to the degree of specificity used to describe defining variables*" (Peters and Heron 1993).

Our longitudinal literature review on higher performance inducing best practices reveals a similar assessment. Ten influential publications with a combined citation count over 6000 were selected, and analyzed in terms of the best practices recommended for organizations wishing to become lean and/or attain higher performance (see Figure 2-2). Please note that unless indicated, we refrained from replicating detailed descriptions should an author include a best practice we have previously described at length.

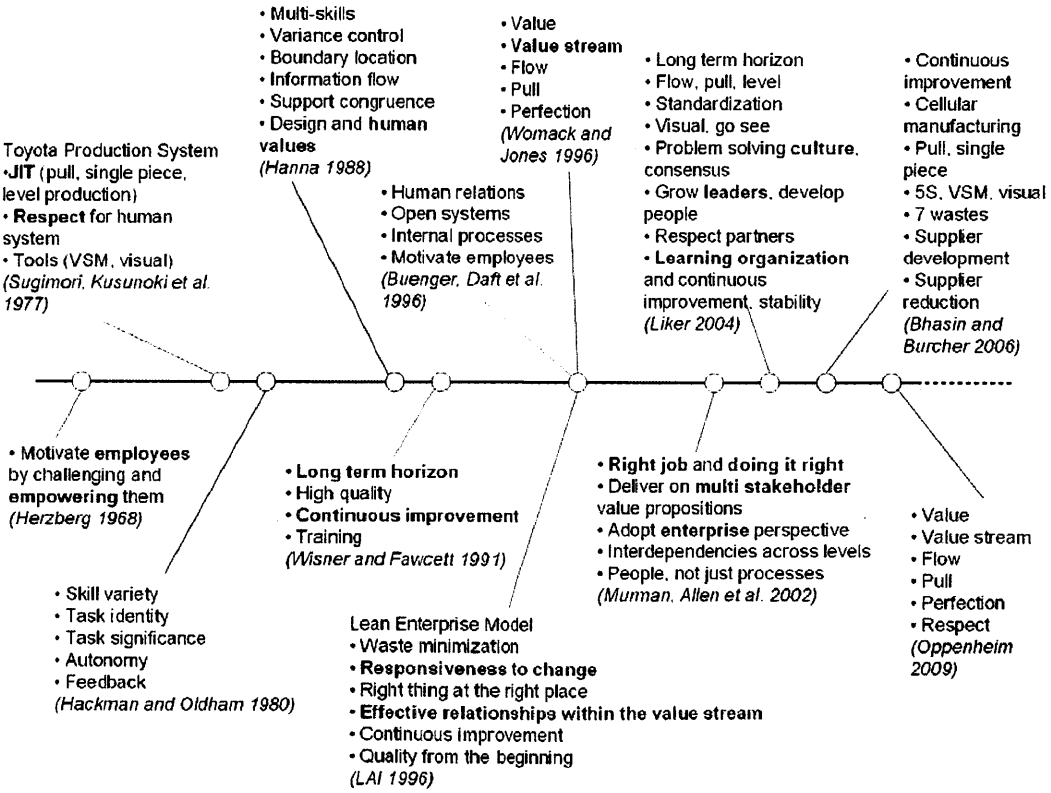

Figure 2-2: Lean principles timeline

Hackman and Oldham (1980)[11] suggested that organizations should follow five key principles to attain higher performance, namely:

- Skill variety: workers should acquire different skills and apply them in different tasks (e.g. quality, inventory management, fitting, etc).
- Task identity: the group task should be a meaningful piece of work which provides a sense of a whole task being completed (i.e. seeing a finished product).
- Task significance: the outcome of the group's work has an impact on others .inside and outside the organization.
- Autonomy: workers have substantial latitude in determining together how the work is to be completed including timing and methods used.
- Feedback: workers should be able to trust and comprehend real time information on how well they are doing their tasks and how they can improve.

Hanna (1988)[12] suggested that organizations should redesign their work practices according to the following six characteristics:

- Multiskills: workers should be skilled in more than one function to allow for system flexibility (e.g. the same function can be performed by different workers).
- Variance control: workers are considered the first line of defense to detect deviations from the ideal process at the point where they originate.
- Boundary location: interdependent roles (e.g. knowledge) should be placed within the same departmental boundaries.
- Information flow: information systems should enable information at the point of action and problem solving as opposed to merely supporting hierarchical authority.
- Support congruence: an organization's social system needs to reinforce desired behaviors via rewards, hiring practices, training, and structure, so that these are congruent with the basic work design and group structures in place.
- Design and human values: a high performing organization provides for its workers high quality of work life and individual fulfillment.

[11] 3611 citations on google scholar as of 15th September 2010
[12] 159 citations on google scholar as of 15th September 2010

Wisner and Fawcett (1991)[13] suggested that world-class manufacturers share four characteristics:

- Long term preference: emphasis on long term factors over short term profitability
- High quality products: develop competitive advantage by producing higher quality products whilst remaining innovative, flexible, and cheap.
- Continuous improvement: sustain competitive advantage through relentless pursuit of continuous improvement at process and product levels.
- Training: fully integrate workforce into all aspects of the manufacturing process

Buenger, Daft et al. (1996)[14] suggest that higher performing organizations are capable of balancing the following four competing values:

- Human relations value: develop high morale among unit members and provide them with the opportunity for growth and development, and ensure that everyone gets along well with each other.
- Open systems value: enable flexibility to adapt to new demands and/or organizational changes on a daily, weekly, or monthly basis.
- Internal process value: work should be organized and predictable so as to achieve maximum efficiency at all times while minimizing disruptions and exerting control over workers and activities.
- Rational goal value: motivate workers to innovate and improve their work practices.

LAI (1996) developed the Lean Enterprise Model (LEM) which suggests the following six core principles:

- Waste minimization: the elimination of non-value added activities is the ultimate goal of a lean organization as it reduces the time and resources required to produce a product or service that delivers value to the customer.
- Responsiveness to change: organizations need to be able to respond to market opportunities so as to produce their product or service when needed.

[13] 120 citations on google scholar as of 15th September 2010
[14] 80 citations on google scholar as of 15th September 2010

- Right thing at the right place, right time, and in the right quantity: every organizational function should perform as needed to meet customer demands.
- Effective relationships within the value stream: efficient organizations require mutual trust and respect, information sharing, and open and honest communication throughout entire value chain (e.g. employees, customers, suppliers, and partners).
- Continuous improvement: the organization as a whole should seek to continuously improve towards perfection.
- Quality from the beginning: schedules and continuous improvement expectations need to be balanced with building quality from the beginning.

Womack and Jones (1996)[15] suggest that high performing lean organizations follow five principles:

- Value: value is product specific and defined from the end-customer's perspective (i.e. product delivered at the right time and at the appropriate price).
- The value stream: identify every step needed for each product family and eliminate waste whenever a step doesn't create value.
- Flow: value creating steps should take place in tight sequence so that value flows smoothly to the customer.
- Pull: allow the customer to pull value from the next upstream activity as required as opposed to pushing product to customer.
- Perfection: lean is a never ending process which continuously seeks perfection through the elimination of waste so that every value stream step creates value.

Murman, Allen et al (2002)[16] suggest that high performing lean organizations follow five principles:

- Create lean value by doing the right job right and by doing the right job
- Deliver value only after identifying stakeholder value and constructing robust value propositions

[15] 1436 citations on google scholar as of 15th September 2010
[16] 114 citations on google scholar as of 15th September 2010

- Fully realize lean value only by adopting an enterprise perspective
- Address the interdependencies across enterprise levels to increase lean value
- People, not just processes, effectuate lean value

Liker (2004)[17] has arguably written the best-selling book series on Toyota and proposed that Toyota derives its higher performance from applying the following 14 principles:

- Base your management decisions on a long-term philosophy, even at the expense of short-term goals: grow and align the organization towards a common purpose that is greater than making money and generates value to all stakeholders.
- Create a continuous process flow to bring problems to the surface.
- Use "*pull*" systems to avoid overproduction.
- Level out the workload (heijunka). (Work like the tortoise, not the hare)
- Build a culture of stopping to fix problems, to get quality right the first time.
- Standardized tasks and processes are the foundation for continuous improvement and employee empowerment.
- Use visual control so no problems are hidden.
- Use only reliable, thoroughly tested technology that serves your people and processes: the introduction of technology should be to support people rather than to replace them. New technologies should be tested and rejected if not aligned with company culture or if likely to disrupt stability and predictability.
- Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others: grow leaders from within rather than getting them from the outside, and have them be role models in embracing the organization's philosophy.
- Develop exceptional people and teams who follow your company's philosophy: create a stable and strong culture that supports the company values and beliefs, and implement cross functional teams to improve quality and productivity.
- Respect your extended network of partners and suppliers by challenging them and helping them improve: respect your partners and consider them as an extension of your business.

[17] 487 citations on google scholar as of 15th September 2010

- Go and see for yourself to thoroughly understand the situation: don't rely on computers or on second hand information and instead personally verify data to solve problems and improve processes
- Make decisions slowly by consensus, thoroughly considering all options; implement decision rapidly: avoid moving down a particular path without having first identified other alternatives. Once a path is chosen move quickly.
- Become a learning organization through relentless reflection and continuous improvement: with a stable process in place (e.g. standardize best practices; slow promotions) leverage continuous improvement and eliminate waste.

Bhasin and Burcher (2006)[18] propose that organizations aspiring to become lean should implement "*most, if not all, of the following*":

- Continuous improvement / Kaizen
- Cellular manufacturing
- Kanban system
- Single piece flow
- Process mapping of order fulfillment process
- Single minute exchange of dies in order to reduce the lead-time and improve flows
- Step change (kaikaku in Japanese): make radical activity improvement to eliminate waste
- Supplier development: develop close links with suppliers for mutual benefit
- Supplier base reduction
- Five S's and general visual management
- Total productive maintenance
- Value and the seven wastes: value should never be ignored and should be delivered to the customer at the right time and at an appropriate price as defined by the customer in each case

[18] 70 citations on google scholar as of 15th September 2010

Oppenheim (2009) proposes that organizations adopt six principles in order to become lean, and essentially offers the same five principles from Womack and Jones (1996) and revisits the human respect principle we referred to earlier (Sugimori, Kusunoki et al. 1977):

- Value Principle
- Value Stream Principle
- Flow Principle
- Pull Principle
- Perfection Principle
- Respect-for-People Principle

2.4.4 Understanding lean failures

The expected benefit of implementing lean was that organizations could function with "*with half or less of the human effort, space, tools, time, and overall expense*" (Womack and Jones 1994). However, several authors have reported that lean often fails to deliver on those expected benefits (Skinner 1986; Fry and Cox 1989; Garvin 1991; Corboy and O'Corrbui 1999; Repenning and Sterman 2001; Baker 2002; Chalice 2005; Emiliani and Stec 2005). The following list includes the most common explanations identified in the literature.

Disregard for organizational context

Some authors argue that one should not draw correlations from the automotive industry to other industries as there are fundamental differences in conditions (Adler and Cole 1993). Other authors advocate that organizational leaders should rely on Toyota's principles as a starting point and develop principles that are right for their own organization (Liker 2004). Organizational idiosyncrasies commonly include corporate culture and human capabilities such as teamwork, leadership, and problem solving (Bhasin and Burcher 2006). An often quoted example is that of General Motors who went through a very slow and painful process in implementing lean because it lacked Toyota's tacit knowledge and deeply culturally embedded routines (Grant 1996).

Narrow lean implementation scope

Most studies that report organizational improvements from lean implementations exhibit a typical focus in only one part of their business, namely operations (Emiliani and Stec 2005), also referred to as individual silos (Allen, Nightingale et al. 2004), instead of adopting a broader mindset beyond the 'shop floor' and across the whole enterprise (Murman, Allen et al. 2002). Such is akin to the organizational performance assessment issues we previously highlighted in terms of the multiple levels of analysis. Furthermore, most organizations tend to narrowly focus on a few lean tools applied to the process level and typically exhibit the simplistic approach of identifying a repetitive process to improve, subsequently conducting a VSM to identify waste in current-state and eliminate it in future-state, eventually implementing the desired changes, and celebrating success (Liker and Morgan 2006). However, as per the section on the origins of lean, lean upholds different principles and relies on multiple tools which function together as a system (see Figure 2-3). Should one of the house pillars and/or foundations weaken, the system as a whole could become compromised. Moreover, "*lean is not so much about the individual principles and practices, but their effective integration and application to meet the pull of customer demand, whether it be an external or an internal customer*" (Nightingale 2002). Similarly, Porter (1996) notes that a competitor gains little by merely imitating some activities and not matching the whole. Finally, as Drucker (1995) succinctly put it: "*What is important is not the tools. It is the concepts behind them.*"

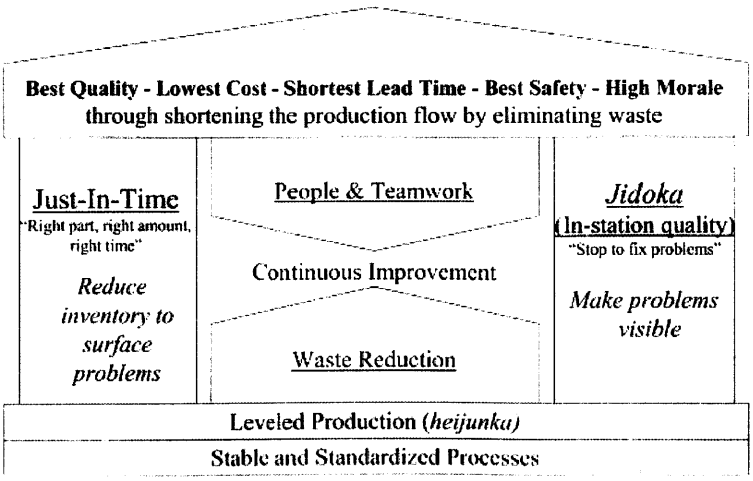

Figure 2-3: The Toyota Production System House (Liker and Morgan 2006)

Disregard for the principle "*respect for the human system*"

Early observations made by US lean experts implied that lean implementations meant layoffs given that "*lean immediately creates large numbers of excess workers and then continuously reduces the amount of effort needed [and that jobs reduction was] a major obstacle confronting any enterprise that is trying to make a performance leap*" (Womack and Jones 1994). However, layoffs due to productivity improvement were later reassessed as a violation of lean's basic principle of "*respect for the human system*" as evidenced in diminished productivity improvements resulting from the remaining people's unwillingness to participate in future improvement activities (Emiliani and Stec 2005). In fact, the assimilation of Toyota's Way implies a greater dependence on people, not less (Liker 2004), as organizations rely on their employees to identify hidden problems, reduce inventory, and fix problems. To that effect Drucker (1992) went as far as advocating that every organization should assume full responsibility for its impact on employees and not simply routinely say that *people are our greatest asset*. Such is akin to the organizational performance assessment issues we previously highlighted in terms of the existence of multiple stakeholders.

Disregard for enterprise strategy and inadequate performance measures

The disregard for enterprise strategy in the planning and execution of lean initiatives is similar to the issue of narrow implementation scopes we just described. Porter (1996) acknowledges that lean production has allowed for significant improvements in manufacturing productivity and asset utilization, as managers became focused on eliminating inefficiencies, improving customer satisfaction, and achieving best practice. However, the author also warns that organizational effectiveness alone is insufficient for companies to remain successful, and that they should first and foremost concern themselves with their strategic positioning. Furthermore, often times traditional accounting methods are inappropriately used in quantifying the benefits of lean as these aren't always obvious (Womack and Jones 2005; Bhasin 2008). Such is akin to the organizational performance assessment issues we previously highlighted in terms of the multiple dimensions of performance.

2.4.5 Understanding the lean enterprise and its core principles

Considering the previous subsection's highlighted factors it is understandable that most organizations claiming to be implementing lean aren't really doing so (Bhasin 2008) and that more often than not they implemented only a few tools and attended some classes (Liker and Morgan 2006). To that effect lean experts offered broader definitions of lean as it being "*customer focused, continually improved through waste reduction, and tightly integrated with upstream and downstream processes as part of a lean value chain*" (Liker and Morgan 2006).

Broader and clearer yet is the definition set forth by MIT's Lean Advancement Initiative (LAI), namely that "*a lean enterprise is an integrated entity that efficiently creates value for its multiple stakeholders by applying lean enterprise principles and practices*" (Murman, Allen et al. 2002). This definition clearly adopts an enterprise perspective (i.e. beyond process) and one which accounts for the existence of multiple stakeholders for who value should be created and delivered (i.e. beyond a single customer and beyond mere waste elimination). The same definition was more recently refined to include both efficiency and effectiveness as follows: "*An integrated entity that efficiently and effectively creates value for its multiple stakeholders by employing lean principles and practices*" (Nightingale 2009). Notably the term Lean Enterprise had surfaced as early as the mid 90's (Womack and Jones 1994) and the existence of multiple stakeholders beyond any individual organization was recognized. However, at the time the proponents of the term assumed that a Lean Enterprise implied the existence of a clear *team leader* capable of unifying the enterprise towards a single customer, whereas the more recent definition doesn't necessarily assume that one predominant stakeholder exists and, more importantly determines that the enterprise should deliver value beyond a single end-customer.

Becoming a lean enterprise has increasingly been recognized as an important enterprise strategy to attain critical goals (Nightingale 2002) which attends to the concern of having in place a mindset of both strategy and operational effectiveness (Porter 1996) and ultimately enables organizations with their business theory (Drucker 1994). Nightingale

(2009) presented the Seven Principles of Enterprise Thinking which leverage MIT's Lean Advancement Initiative expert opinion, extensive empirical research and previous publications, as follows:

1- Adopt a holistic approach to enterprise transformation: a holistic approach is recommended at three levels. Firstly, organizations should find the balance between short term success and achieving long term enterprise level benefits. Secondly, organizations should avoid merely achieving *islands of success* and adopt an enterprise level lens. Thirdly, organizations should look at their processes and beyond, namely strategy, organization, knowledge, information technology, service/product architecture, and external factors.

2- Identify relevant stakeholders and determine their value propositions: this principle stems from LAI's Lean Enterprise definition which accounts for the existence of multiple stakeholders for who value should be created and delivered (i.e. beyond a single customer and beyond mere waste elimination). Enterprises should identify what each of their stakeholders value, determine the value being delivered both by the enterprise to the stakeholders and vice-versa.

3- Focus on enterprise effectiveness before efficiency: this principle warns of traditional lean approaches that only seek process efficiency and in doing so may run counter to a desired or needed strategy. As such enterprises should focus on "*doing the right thing*" before "*doing it right*".

4- Address internal and external enterprise interdependencies: when analyzing transformation efforts enterprises are advised to consider what they control and influence, as well as what constraints they have. The desired transformation sets the scope to be considered part of the enterprise boundary, and the enterprise needs to address the interdependencies both internally and externally. Particular attention is recommended at the boundaries of the enterprise as these may hold the greatest room for improvement.

5- Ensure stability and flow within and across the enterprise: enterprise stability is desired so that an enterprise may understand its current state and form a baseline for improvement. At the enterprise level informational flow is the most significant entity, rather than material flow. It is important to see end-to-end value delivery (i.e. within and across the enterprise) in order to identify focal points for improving value delivery to key stakeholders.

6- Cultivate leadership to support and drive enterprise behaviors: this principle emphasizes the importance of communicating strategy across the various enterprise levels and recommends to that effect that enterprises nurture grass root leadership who are committed to the enterprise's mission and also financially support ongoing improvement activities.

7- Emphasize organizational learning: this principle embodies the continuous experimentation and knowledge gain at all levels of the enterprise with both top-down and bottom-up orientation. A key aspect is that the enterprise as a whole must be able to learn and benefit from localized improvement efforts, so that it in turn may improve the effectiveness of the improvement efforts undertaken.

2.4.6 Theoretically bolstering LAI's Lean Enterprise Principles

At the beginning of this section we described the literature's assessment that proposed best practices commonly lack the benefit of scholarly research and have produced at times bandwagon effects which led to ineffective or even harmful outcomes. Then we further identified how studies have negatively characterized the proliferation of best practices lists, and we gave evidence that the same could be observed in the realm of best practices for organizational performance. It is our opinion that the Lean Enterprise Principles represent the latest development in lean thinking, and in line with that, they were presented in 2009 at MIT's Engineering Systems Division 2nd International Symposium on Engineering Systems. Nonetheless we also value the earlier recommendations we noted on how to establish powerful and useful best practices,

namely that these must not only be the product of expert opinion, but also have empirical support as well as some underpinning with existing literature on that practice or related practices. Hence, what follows is the result of an in-depth literature analysis that bolsters the theoretical underpinning of LAI's proposed Lean Enterprise Principles.

2.4.6.1 Literature review supporting Lean Enterprise Principles

Table 2-3 includes a total of 67 publications that span across different disciplines and range from as early as 1958 to 2009[19]. Some of the Lean Enterprise Principles could arguably have a list of thousands of articles as their concepts have been independently developed in multiple fields. For instance, principle 2 concerns the identification of relevant stakeholders and determining their value propositions, which can be traced to the established theory of stakeholders (Freeman 1984; Mitchell, Agle et al. 1997) and has prominently featured in several masters and doctoral level theses (Davidz 2006; Stanke 2006; Haddad 2008; Sgouridis 2008; Glazner 2009).

Table 2-3: Literature review supporting Lean Enterprise Principles

Decade	Reference	Lean Enterprise Principle(s)							Paper
		1	2	3	4	5	6	7	
50s	(March, Simon et al. 1958)		X						Org theory
60s	(Drucker 1963)			X					Strategy
	(Perrow 1967)	X				X			Org theory
	(Herzberg 1968)							X	Management
	(Skinner 1969)			X					Manufacturing
70s	(Miles, Snow et al. 1974)		X						Org theory
	(Etzioni 1975)						X		Org theory
	(Shortell 1976)		X						Healthcare
	(Sugimori, Kusunoki et al. 1977)		X			X			Lean
80s	(Hayes and Abernathy 1980)	X							Management
	(Van de Ven and Ferry 1980)		X						Org theory
	(Iii and Leifer 1983)				X				Org theory
	(Shrivastava 1983)							X	Org theory
	(Freeman 1984)		X						Org theory
	(Schein 1985)						X		Org theory
	(Skinner 1986)			X					Manufacturing

[19] For a detailed list of excerpts from each reference in Table 2-3 please refer to Appendix I

Decade	Reference	Lean Enterprise Principle(s)							Paper
		1	2	3	4	5	6	7	
	(Donabedian 1988)	X		X					Healthcare
	(Drucker 1989)			X					Strategy
	(Fawcett 1989)	X							Lean
	(Fry and Cox 1989)	X		X					Perf. measurement
	(Ragin 1989)	X			X				Research method
	(Berwick 1989)		X						Healthcare
	(Venkatraman 1989)	X							Strategy
90s	(Tsui 1990)	X			X				Perf. measurement
	(Wisner and Fawcett 1991)	X		X					Perf. measurement
	(Meyer, Tsui et al. 1993)	X							Org theory
	(Ostroff and Schmitt 1993)			X					Org theory
	(Peters and Heron 1993)		X						Best practice theory
	(Drucker 1994)	X			X		X		Strategy
	(Fjortoft and Smart 1994)						X		Org theory
	(Flood 1994)		X						Healthcare
	(Womack and Jones 1994)		X	X	X				Lean
	(Clarkson 1995)		X						Stakeholder theory
	(Denison and Mishra 1995)						X		Org theory
	(Drucker 1995)				X				Strategy
	(Neely, Gregory et al. 1995)	X		X					Perf. measurement
	(Grant 1996)		X		X			X	Org theory
	(Porter 1996)	X		X	X	X	X		Strategy
	(Womack and Jones 1996)	X			X	X		X	Lean
	(Worley, Hitchin et al. 1996)	X			X				Org theory
	(Grant 1997)		X		X			X	Org theory
	(Hauser and Katz 1998)			X					Perf. measurement
	(Lockamy Iii and Spencer 1998)	X		X					Perf. measurement
	(Nancy 1999)	X							Lean
00s	(Hauser 2001)						X		Management
	(Richard and Amy 2001)					X	X	X	Org learning
	(Carroll and Edmondson 2002)				X	X	X	X	Org learning
	(Drucker 2002)						X		Management
	(Inamdar and Kaplan 2002)			X			X		Perf. measurement

Decade	Reference	Lean Enterprise Principle(s)							Paper
		1	2	3	4	5	6	7	
	(Murman, Allen et al. 2002)	X	X	X	X				Lean
	(Nightingale 2002)	X		X	X	X			Systems thinking
	(Needy, Norman et al. 2002)		X						Lean
	(Benner and Tushman 2003)		X		X				Org theory
	(Rouse and Putterill 2003)		X						Perf. measurement
	(Bazzoli, Dynan et al. 2004)		X						Healthcare
	(Liker 2004)	X	X			X	X	X	Lean
	(Roos, de Neufville et al. 2004)	X	X						Systems thinking
	(Barki and Pinsonneault 2005)				X				Org theory
	(Becker 2005)					X		X	Org theory
	(Emiliani and Stec 2005)	X	X	X	X		X		Lean
	(Reijers and Liman Mansar 2005)			X					Lean
	(Liker and Morgan 2006)	X				X		X	Lean
	(Folan, Browne et al. 2007)			X					Perf. measurement
	(Bhasin 2008)						X		Lean
	(Rhodes and Nightingale 2008)		X						Systems thinking
	(Valerdi, Nightingale et al. 2008)			X					Systems thinking
	(Hussey, Eibner et al. 2009)		X						Healthcare

Similarly, principle 5 which concerns stability and flow within and across the enterprise has benefited from in-depth study in multiple disciplines including organizational theory, operations research, management, and beyond. Yet another example is that of principle 3 where Drucker already in the early 60s had noted on the "*confusion between effectiveness and efficiency that stands between doing the right things and doing things right. There is surely nothing quite so useless as doing with great efficiency what should not be done at all.*" (Drucker 1963). Indeed one could argue that the concepts supporting each of the Lean Enterprise Principles aren't novel in themselves and in fact some of the publications in Table 2-3 address several of them. However, as a counter argument one must consider two important factors which are outlined next.

2.4.6.2 Examining Toyota's recent widely publicized turmoil through the Lean Enterprise Principles

Firstly, as previously noted in our analysis of lean failures, lean as with other philosophies, is "*not so much about the individual principles and practices, but their effective integration and application*" (Nightingale 2002). For instance, without an appreciation for long-term results (i.e. principle 1) one may falter by focusing on short-term efficiency gains that might compromise an enterprise's overall effectiveness in the longer run (i.e. principle 3). Similarly, establishing where an enterprise boundary lies (i.e. principle 1) is inherently related to the identification of the relevant stakeholders to be considered (i.e. principle 2) which in turn affects the value interpretations of what constitute efficiency gains versus effectiveness (i.e. principle 3) and how, where, and by whom are these delivered (i.e. principle 4).

In fact, Toyota itself has recently undergone significant public scrutiny in light of high profile accidents involving faulty breaking systems which tarnished what was regarded as the immaculate quality standard stemming from its lean enterprise thinking. In early 2010 Toyota issued a recall of 8.5 million vehicles worldwide and halted U.S. sales of eight models equipped with the faulty pedals, while its CEO Akio Toyoda[20] underwent fierce questioning at a hearing presided by the House Committee on Oversight and Government Reform in the US. Peer reviewed publications with detailed evidence on what led to this failure have yet to surface, however one can examine official public statements made by senior Toyota officials (Greimel 2010; Greimel and Jackson 2010; Greimel, Treece et al. 2010) and infer that Lean Enterprise Principles were disregarded and might have led to Toyota's worldwide crisis. As he addressed the committee Mr. Toyoda conceded:

- "*I would like to point out here that Toyota's priority has traditionally been: first safety; second quality; and third volume. These priorities became confused*"
- "*We pursued growth over the speed at which we were able to develop our people and our organization and we should sincerely be mindful of that*"
- "*Quite frankly, I fear the pace at which we have grown may have been too quick*"
- "*I regret that this has resulted in the safety issues described in the recalls and I*

[20] Mr. Akio Toyoda is the grandson of Toyota's founder Mr. Kiichiro Toyoda who named his enterprise "Toyota" as he believed his new venture would be more successful that way.

am deeply sorry for any accidents that Toyota drivers have experienced."

In a separate interview (Greimel and Jackson 2010) Mr. Akio Toyoda said "*I don't think we were wrong to expand, but we may have stretched more than we should have*". The same article quotes him as having said at a press interview that his father Mr. Shoichiro Toyoda had been a "*flag*" around which the company traditionally rallied in tough times, and that he felt he wasn't "*yet that flag, but I intend to do my best so that maybe 20 or 30 years from now, people may look back and refer to me as a flag*". Toyota's former North American chief, Mr. James Press, is also quoted in the article as saying that "*the root cause of their problems is that the company was hijacked, some years ago, by anti-family, financially oriented pirates*". He was referring to Mr. Hiroshi Okuda who became the first non Toyoda CEO in almost 30 years and who introduced more Western-style, financially driven tactics such as listing Toyota in the New York Stock Exchange (which forced it to adopt U.S. accounting principles and meeting its stockholder expectations) and taking over ownership in suppliers (e.g. minicar specialist Daihatsu Motor Co) rather than rely on its previous strategy of relying on informal ties.

Considering these statements one can suggest that Toyota disregarded several of the Lean Enterprise Principles. To begin with it focused on growing to deliver financial results with a short-term mindset (i.e. rather than Principle 1 long-term recommendation) whilst sacrificing safety and quality (i.e. risking Principle 2 stakeholder values). The increase in production and proliferation of car models also implied subjecting its production base to a significant spike (i.e. disregarding the stability implied in Principle 5) and adopting different tactics to manage those interdependencies (i.e. Principle 4). Furthermore, the leadership of Mr. Okuda clearly didn't uphold the same values of its predecessors (i.e. Principle 6) and placed Toyota as a whole at risk (i.e. Principle 3). Finally, given this setting one can assume that Toyota was no longer able to continue its pursuit of perfection as it did before (i.e. Principle 7). Ultimately, the seven Lean Enterprise Principles can help guide the development and sustainment of a lean enterprise while avoiding the previously described lean failures as well as Toyota's own recent turmoil.

2.4.6.3 Rethinking the entire enterprise through the Lean Enterprise Principles

The second counter argument attesting to the Lean Enterprise Principles' contribution, concerns principle 1 in particular (i.e. adopt a holistic view of the enterprise). Specifically, although drafted in the context of deriving lean enterprises, principle 1 is equally applicable on a recommended research approach informed by systems thinking. In other words, when studying organizations it is important to adopt a holistic approach that covers both short and long-term horizons within and across multiple departments and organizations, and doing so with an awareness and appreciation of multiple organizational characteristics[21]. For instance, the richness of the literature review reveals that scholarly publications on lean at first (and several of them still do) focus on the process, tool, and individual levels, and over time gradually develop towards understanding broader concepts of organizational learning culture and organizational strategy. Nonetheless, catering for an enterprise systems thinking perspective is still predominantly absent even when several of the Lean Enterprise Principles are being considered. For instance, organizational learning (i.e. principle 7) indeed requires a supportive leadership (i.e. principle 6) in order to nurture a culture of improvement amongst employees, suppliers, etc (i.e. principle 2). However, such learning and improvement is often described at the local level (e.g. individual at the assembly line pulling a chord signaling a problem and thus triggering problem solving) instead of maintaining an enterprise perspective (e.g. could this local improvement be standardized and applied elsewhere in the enterprise? Is this local improvement going to hinder our enterprise overall? Do we need to make a conscious decision of sustaining undesirable performance locally for the betterment of the enterprise as a whole?).

All in all, the seven Lean Enterprise Principles embody the understanding that "*the full benefits of lean can be realized only by re-thinking the entire enterprise*" (Nightingale 2002). With this understanding in mind, in the next and final part of this chapter we address hospital enterprise performance measurement. In doing so we consolidate our literature review in terms of the first two research questions posited in this thesis[22].

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[21] To be explored in detail in Chapter 3.
[22] Please refer to section 1.5.

Specifically, we first analyze in detail the challenges inherent in measuring hospital enterprise performance, and we then conduct a longitudinal and multidisciplinary literature review focused on hospital performance measurement[23].

2.5 Measuring Hospital Enterprise Performance

Several developed nations around the world are grappling with high healthcare expenditures and unsatisfactory outcomes. High level country benchmarks show that there is wide variation in health outcomes for countries with similar levels of income and education (Preston 1986; World_Bank 1993; OECD 2007), and the US healthcare system in particular is often singled out as the least effective system amongst developed countries (National_Academies 2006). A common US and UK characteristic is that the highest source of healthcare expenditures are hospital services and infrastructure (Kaiser Foundation 2007; UK_Department_of_Health 2008). Consequently, the strategies and operations developed and implemented by hospitals have a significant effect on access, quality, and cost of care (Devers, Brewster et al. 2003). However, a universally accepted definition of quality of care has yet to surface (Donabedian 1988; Blumenthal 1996; Campbell, Roland et al. 2000) which not only hinders country level performance benchmarks but also those comparing hospitals within the same country.

2.5.1 The challenge of measuring hospital enterprise performance

This section describes in further detail key challenges of measuring hospital enterprise performance, whilst using the issues referred in section 2.3, namely the existence of multiple levels of analysis, of multiple stakeholders, and multiple performance dimensions.

[23] For a broader analysis of the healthcare industry and hospitals in particular, please refer to the healthcare literature review presented in Chapter 4.

2.5.1.1 Multiple levels of analysis

Avedis Donabedian, who has been referred to as one of the founders of the modern science of health care quality measurement (Romano and Mutter 2004), said that the term health care was vague and "*capable of many interpretations, since its meaning varies with how narrowly or broadly health and the responsibility for health are defined, and on how inclusive the level of assessment is [which] depend, in turn, on the overall context for the assessment*" (Donabedian 1988a). Donabedian further explained that "*it makes a difference in the assessment of our performance whether we see ourselves as responsible for bringing about improvements only in specific aspects of physical or physiological function or whether we include psychological and social function as well*" (Donabedian 1988b). For instance, the World Health Organization produced a report (World Health 2000) in which it identifies as overall health care system goals to achieve good health for the population whilst ensuring that health services are responsive to the public and that fair payment systems are in place. Around the same time, the Institute of Medicine stated that "*the purpose of the health care system is to reduce continually the burden of illness, injury, and disability, and to improve the health status and function of the people of the United States*" (IOM 2001). As such, some have argued that medicine in itself doesn't cover the full spectrum of health care as it only offers a specialized approach to disease cure and that the greatest health advance of all time was cleaning up the water supply (Glouberman and Mintzberg 2001), a feat which clearly resides beyond the responsibility of an individual hospital and is representative of the danger of defining health care quality too broadly (Donabedian 1993).

Notably a group of health care experts produced a research agenda aimed at improving the US health care system (Fernandopulle, Ferris et al. 2003), and one of the highest priorities for research identified was to develop more robust performance measures which would allow identifying high performing hospitals and distinguish which of their practices are more successful than others.

2.5.1.2 Multiple stakeholders

The existence of multiple stakeholders in the health care system was recognized as a complicating factor as early as the mid seventies when public opinion and experts alike demanded greater organizational responsiveness and accountability from hospitals, who often had to reconcile incompatible objectives (Shortell 1976). Similarly, and more recently, the existence of multiple stakeholders in the health care system has made unclear who the consumer is of any health improvement initiative (Schneider and Epstein 1996).

Specifically, a fundamental obstacle towards achieving consensus on who the consumer is and what healthcare performance constitutes, is that health is a social construct (Turner and Samson 1995) that reflects the views of medical professionals (Freidson 1970) as well as those of other individuals and society at large (Nettleton 1995), including varying expectations of client/provider relationships, valuations of health, and what constitute "*legitimate roles of the health care enterprise*" (Donabedian 1988a). For instance, organizations responsible for measuring hospital quality such as the National Committee for Quality Assurance (NCQA) and the Joint Commission for the Accreditation of Health Care Organizations (JCAHO) have historically focused on what are commonly referred as "*process measures*" (i.e. was evidence based medicine applied?), whereas consumer and employer focused organizations have opted to reward hospitals for their outcomes (e.g. mortality and length of stay) and structural measures (e.g. is a computerized physician order entry system installed?) (Romano and Mutter 2004). Another perspective is that of patients who emphasize factors such as access, communication, and kindness (Wensing, Grol et al. 1994), as well as cost (Wicks and St. Clair 2007) and who amid a poor experience may decide not to seek care in the future with a particular physician and/or hospital (Murray and Corney 1990). Furthermore, insurance companies may demand special prices in return for encouraging patients to use the specific hospital (Flood 1994).

Moreover, measuring the performance of a hospital enterprise is particularly challenging given the varying and potentially conflicting definitions of healthcare which are upheld

by different stakeholders (e.g. patients, insurance companies, physicians, nurses, hospital board, regulators, employers, pharmaceuticals, medical devices, etc) and demanded of hospital leaders who in turn attempt to set the direction and induce desirable behavior for their organization to become and remain a high performing hospital. Furthermore, it isn't always easy to identify and distinguish stakeholder groups and coalitions within the same hospital (Fennell and Alexander 1989). Hospitals may have salaried and/or non-exclusive physicians who expect cutting edge facilities. In turn, hospital departmental managers may each measure their departmental performance differently as they keep in mind their own individual objectives (Parker, Charns et al. 2001), and the same could be said of the remaining internal stakeholders. All the while, hospital management is monitored by the hospital board to hopefully prevent and contain any self-interested action (Flood 1994).

2.5.1.3 Multiple dimensions of performance

As per our discussion, the existence of multiple levels of analysis and multiple stakeholders necessarily implies that we consider multiple dimensions of performance. A hospital that performs well on one dimension may not necessarily perform well on others, and one may derive the wrong conclusion by focusing on a single measure or even multiple measures of the same dimension (Romano and Mutter 2004). For instance, quality and cost (i.e. finance) dimensions are often said to be in tension as per hospital performance measurement studies (Eddy 1998; Bazzoli, Chen et al. 2008). Similarly, hospitals that perform well on one medical condition have been found to perform poorly for unrelated conditions (Rosenthal 1997).

Another important dimension is patient satisfaction (Feinstein 2002) which may be considered a desired outcome of care since a satisfied patient is more likely to follow and implement his or her designated treatment (Donabedian 1988a). However, most patients are said to be unable to evaluate the technical quality of care (i.e. the appropriate use of evidence based medicine) unless an adverse event takes place (Wicks and St. Clair 2007). As such, health care professionals often discount the importance of patients' perspectives (Blumenthal 1996) and additionally fear that patients may value more convenience, waiting time, and physician availability (Blumenthal and Epstein 1996). Nonetheless,

despite the potential validity issues of patient satisfaction as a measure of quality, experts have argued that it is an indispensible dimension to improve health care systems (Donabedian 1988b).

2.5.2 Literature review on hospital performance measurement

So far we have highlighted hospital performance dimensions of a financial, operational, quality, and customer satisfaction nature, but there are others. As a means of identifying the performance dimensions and associated metrics that are most commonly used by scholars to assess hospitals, a review of relevant articles published over the forty eight year time period of 1962 through 2009, was conducted. Forty influential articles with a combined citation count over 4500 were selected from the most prominent health care publications, including *Health Affairs, New England Journal of Medicine, Journal of the American Medical Association, Journal of Healthcare Management, Journal of Health Economics, Medical Care, British Medical Journal, European Journal of Health Economics,* as well as the management publications of the *Academy of Management Journal, Administrative Science Quarterly, Journal of Operations Management*, and *Harvard Business Review.* Each study was examined to determine the dimensions used to measure hospital performance, its level of analysis (hospital wide, hospital department, system wide), its research contribution (conceptual and/or empirical), and whether specific metrics were proposed. Our literature review findings are presented in Table 2-4 below.

Table 2-4: Literature review on hospital performance measurement

#	Reference	Metrics specified?	Unit of analysis (*)	Data?	Financial	Operational	Quality	Customer satisfaction	Employee satisfaction	Social Equity	Strategy / Operations alignment	Org Learning	Total dimensions
1	(Blumenthal 1996)	Yes	H	No	0	0	1	0	0	0	0	0	1
2	(Bazzoli, Chen et al. 2008)	Yes	H	Yes	1	0	0	0	0	0	0	0	1
3	(McCue, Clement et al. 1999)	Yes	H	Yes	1	0	0	0	0	0	0	0	1
4	(Kane 1991)	Yes	H	Yes	1	0	0	0	0	0	0	0	1
5	(Mukamel, Zwanziger et al. 2002)	Yes	H	Yes	0	0	1	0	0	0	0	0	1
6	(Clement, McCue et al. 1997)	Yes	H	Yes	1	0	0	0	0	0	0	0	1
7	(Jones and Sidebotham 1962)	Yes	H	Yes	0	1	0	0	0	0	0	0	1
8	(Becker and Sloan 1985)	Yes	H	Yes	1	0	0	0	0	0	0	0	1
9	(Grosskopf and Valdmanis 1987)	Yes	H	Yes	0	1	0	0	0	0	0	0	1
10	(Romano and Mutter 2004)	Yes	H	No	0	0	1	1	0	0	0	0	2
11	(Donabedian 1988a)	Yes	S	No	0	0	1	1	0	0	0	0	2
12	(Rego, Nunes et al. 2009)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
13	(Clement and McCue 1996)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
14	(Alexander and Rundall 1985)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
15	(Goldstein, Ward et al. 2002)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
16	(Hrebiniak and Alutto 1973)	Yes	U	Yes	1	1	0	0	0	0	0	0	2
17	(Ashmos, Duchon et al. 2000)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
18	(Fisher, Staiger et al. 2007)	Yes	H	Yes	1	0	1	0	0	0	0	0	2
19	(Gillies and Shortell 1993)	No	H	Yes	0	1	1	0	0	0	0	0	2
20	(Spear 2005)	Yes	U / H	Yes	0	1	1	0	0	0	0	0	2

Note: (*) Please read "Unit of analysis" as follows: "H" = Hospital ; "U" = Hospital Unit (e.g. emergency department) ; "S" = Health system wide
A table cell colored in red highlights that "No" data was present, whereas a table cell colored in green highlights that the dimension was used.

Table 2-4 (cont): Literature review on hospital performance measurement

#	Reference	Metrics specified?	Unit of analysis (*)	Data?	Financial	Operational	Quality	Customer satisfaction	Employee satisfaction	Social Equity	Strategy / Operations alignment	Org Learning	Total dimensions
21	(Shortell, Gillies et al. 1994)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
22	(Shortell, Rousseau et al. 1991)	Yes	U	Yes	0	0	1	0	1	0	0	0	2
23	(Doty, Glick et al. 1993)	Yes	H	Yes	1	1	0	0	0	0	0	0	2
24	(Argote 1982)	Yes	U	Yes	0	1	1	0	0	0	0	0	2
25	(Pronovost, Jenckes et al. 1999)	Yes	U	Yes	0	1	1	0	0	0	0	0	2
26	(Donabedian 1988b)	Yes	S	No	0	0	1	1	0	1	0	0	3
27	(Griffith and Alexander 2002)	Yes	H	Yes	1	1	1	0	0	0	0	0	3
28	(Ozcan, Luke et al. 1992)	Yes	H	Yes	1	1	0	0	0	0	0	1	3
29	(Shortell, Zimmerman et al. 1994)	Yes	U	Yes	0	1	1	0	1	0	0	0	3
30	(Cortese and Smoldt 2007)	Yes	H	No	1	0	1	1	0	0	1	0	4
31	(IOM 2001)	No	S	No	1	1	1	0	0	1	0	0	4
32	(Counte, Glandon et al. 1995)	Yes	H	No	1	1	1	1	1	0	0	0	5
33	(Maxwell 1984)	No	S	No	1	1	1	1	0	1	0	0	5
34	(Georgopoulos 1978)	Yes	U / H	No	1	1	1	1	1	0	1	0	6
35	(Wicks and St. Clair 2007)	Some	H	No	1	1	1	1	1	0	0	1	6
36	(Jonathan, Steven et al. 2000)	Yes	H	No	1	1	1	1	1	1	0	0	6
37	(Martin, Nelson et al. 2007)	Yes	S	No	1	1	1	1	1	1	0	0	6
38	(Veillard, Champagne et al. 2005)	Yes	H	No	0	1	1	1	1	1	0	1	6
39	(Campbell, Roland et al. 2000)	No	S	No	0	1	1	1	1	1	1	0	6
40	(Abernethy and Lillis 2001)	No	U	Yes	1	1	1	0	1	0	1	1	6

Note: (*) Please read "Unit of analysis" as follows: "H" = Hospital ; "U" = Hospital Unit (e.g. emergency department) ; "S" = Health system wide
A table cell colored in red highlights that "No" data was present, whereas a table cell colored in green highlights that the dimension was Used.

Upon inspecting the above table, a trend is evident in that the number of dimensions considered in published articles increased over time, which reflects the maturation of the performance management literature that recognized the need for multi dimensional performance measurement. However, Table 2-5 indicates that an inverse relationship exists between the number of performance dimensions described and the inclusion of empirical data in the studies (i.e. beyond a conceptual contribution on how to measure hospital performance). Moreover, as the number of performance dimensions included in the studies increased (i.e. table cells colored in green) the inclusion of data in such studies decreased (i.e. table cells colored in red).

Table 2-5: Relationship of hospital performance dimensions and empirical studies

# dimensions	# refs	# w. data
1	9	8
2	16	14
3	4	3
4	2	0
5	2	0
6	7	1

A total of eight hospital performance dimensions were identified as follows: financial, operational, quality, customer satisfaction, employee satisfaction, strategy and operations alignment, social equity, and organizational learning. Table 2-6 includes sample metrics which were most commonly used in each performance dimension.

Table 2-6: Sample metrics used in each performance dimension

Performance Dimension	Metrics
Customer Satisfaction	Patient satisfaction. Patient likelihood to recommend provider in the future. Responsiveness to community expectations.
Employee Satisfaction	Absenteeism. Turnover. Employee tenure. Nurse and physician satisfaction.
Finance	Market share. Total operating margin. Return on assets. Cash flow to revenues ratio. Cost per discharge. Cost per patient day. Net patient revenues.
Operations	Length of stay. Bed occupancy. Number of ambulatory visits. Number of emergency visits. Number of inpatient days. Number of outpatient surgeries.

Organizational Learning	Training hours per employee. New technology investment. Employee development programs.
Quality	Mortality. Morbidity. Technical quality of care. Number of patient readmissions. Quality of interpersonal relationship with patient. Number of malpractice claims.
Social Equity	Stratified measures in terms of patient age, gender, income, race, payer, etc.
Strategy / Operations Alignment	Service unit consensus on goal priorities. Inter service unit cooperation.

An analysis of the distribution of dimensions used across the time period reveals the most predominant dimensions as well as an indication of their theoretical maturity. Table 2-7 summarizes the analysis and indicates that "*Operational*" is the most common performance dimension, followed by "*Financial*", "*Quality*", "*Customer Satisfaction*", "*Employee Satisfaction*", "*Social Equity*", and finally "*Strategy and Operations Alignment*" and "*Organizational Learning*". The sparse number of studies published with data could be representative of the nascent phase of theoretical development of the performance dimension(s), or indeed the inherent bias of the author(s) of each study.

Table 2-7: Hospital performance dimension predominance in the literature

Dimensions	**# refs**	**# w. data**
Operational	27	18
Financial	25	17
Quality	24	10
Customer satisfaction	12	0
Employee satisfaction	10	3
Social Equity	7	0
Organizational Learning	4	2
Strategy/operations alignment	4	1

Finally, as per Table 2-5, one of the articles (Abernethy and Lillis 2001) provides a valuable contribution in that it offers the most multidimensional assessment of hospital performance and also includes empirical data. However, the article only relies on perceptual data from survey respondents and thus lacks external validity both in terms of comparing and contrasting with other subjective sources of evidence (e.g. interviews, observation, etc) and with quantitative data (e.g. archival records). Furthermore, the

remaining articles that propose four or more performance dimensions are only at a conceptual phase and don't yet include empirical data.

Ultimately, there is sparse empirical evidence as to what extent hospitals are adopting a multidimensional perspective of performance. To that effect, in the context of this thesis it is pertinent to ask: ***How is hospital enterprise performance currently measured?***

Furthermore, as seen in this thesis section on Lean Enterprise Principles, the proposed seven Lean Enterprise Principles embody the understanding that "*the full benefits of lean can be realized only by re-thinking the entire enterprise*" (Nightingale 2002). To that effect, this thesis poses the follow-on research question: ***How could hospital enterprise performance measurement be improved using lean enterprise principles?***

2.6 Further Detail Concerning First Two Research Questions

Having defined this thesis' first two research questions we revisit the literature review analysis presented earlier in this chapter, and provide further detail towards the intended contribution concerning the abovementioned research questions. Also, we provide an additional literature review specifically concerning widely published guidelines on how to derive useful performance metrics, as well as known pitfalls to avoid.

2.6.1 Proposing systems thinking criteria, and metrics where appropriate

Earlier in section 2.3 we reviewed the literature in terms of operationalizing organizational performance assessments. In doing so, we established that it was recommended that performance measurements reflect multiple stakeholders, as well as multiple levels of analysis, and ultimately the use of multiple dimensions. Specifically, we provided an overview as to how performance measurement evolved from traditional accounting performance measures, towards multidimensional frameworks. The latter were described as being able to provide a more balanced view of organizational

performance and to that effect included non-financial, external, and future looking performance measures, together with the financial, internal, and past performance measures (Bourne, Mills et al. 2000). We also observed, as with the difficulties introduced with increasing the number of stakeholders considered, the proliferation of frameworks has rendered impossible any attempt to develop a single framework for performance measurement (Rouse and Putterill 2003). Furthermore, performance measurement frameworks or scorecards don't in themselves define the best strategy for an organization to adopt (Bhasin 2008) and aren't necessarily rooted on any particular management practice (Chang 2007). We partially address this limitation in adopting lean enterprise principles as a recommended "*theory of the business*" for hospitals to follow, as evidenced in the definition of this thesis' second research question.

Furthermore, our intended contribution isn't to add yet another performance measurement framework to the existing arsenal available to senior hospital leaders. Suggesting key criteria rather than proposing new performance frameworks, has been regarded a preferable contribution by performance measurement scholars (Neely, Gregory et al. 2005). Similarly, healthcare scholars (Martin, Nelson et al. 2007) have recommended the definition of a small set of high-level metrics capable of bringing a systems perspective, while complementing hospitals' traditional large sets of highly specific measures (e.g. financial, operations, quality, etc).

All in all, in this research an attempt is made to characterize key criteria, informed by lean enterprise principles, and from this suggest performance dimensions, metrics, and processes where appropriate. Furthermore, in deriving our descriptions we specifically take into account crucial features of hospital activity so as to further tailor our recommendations to the context of senior hospital leaders.

2.6.2 Key guidelines for establishing useful metrics

At the core of any performance measurement system are its individual performance measures, which if appropriately selected, "*give a clear signal to all people in the company about the priorities that are important to [a] senior manager*" (Maskell 1991).

The definition of what is *appropriate* is particularly important, given that "*every metric, whether it is used explicitly to influence behavior, to evaluate future strategies, or simply to take stock, will affect actions and decisions*" (Hauser and Katz 1998). Specifically, inadequately designed metrics can result in dysfunctional behavior as individuals are encouraged to pursue inappropriate courses of action (Neely, Richards et al. 1997). Hence, it is important to keep in mind literature recommendations on how to derive appropriate metrics (see Table 2-8), as well as to anchor them on an established "theory of the business" (i.e. lean enterprise principles).

Table 2-8: Key guidelines for establishing useful metrics

Reference	Recommendation
(Globerson 1985; Maskell 1991; Wisner and Fawcett 1991; Kaplan and Norton 1993; Bourne, Mills et al. 2000; Folan, Browne et al. 2007)	Metrics should be derived from strategy
(Globerson 1985)	Metrics should be measurable and relate to competitive dimensions that are critical to the success of the organization
(Globerson 1985; Neely, Richards et al. 1997)	Metrics should be transparent and be simple to understand
(Maskell 1991; Jonathan, Steven et al. 2000; Melnyk, Stewart et al. 2004)	A fewer number of pertinent metrics is preferable so as to reduce potential for metric conflict, information overload, or myopia (i.e. overemphasizing one criteria with many metrics)
(Neely, Gregory et al. 1995)	The selection of a metric should take into account the organization's culture in order to minimize erroneous data (e.g. a culture of blame would purposefully underreport the number of part defects for fear)
(Neely, Richards et al. 1997)	Metrics should clearly specify their purpose and the sources of data to derive them
(Hauser and Katz 1998)	Metrics should not: induce narrow thinking; be costly to measure (i.e. keep people from producing value); be precisely wrong (i.e. "*vaguely right is better than precisely wrong*"); deviate from organization goals; be far from what individuals control (i.e. the link between task and measure has to be clear); delay rewards (i.e. individuals need short-term rewards whereas organizations think long-term)
(Eddy 1998; Rouse and Putterill 2003)	Metrics should define the area whose performance is to be measured (i.e. intended audience) and the appropriate level of detail should be used

(Bourne, Mills et al. 2000)	Design metrics that encourage behaviors that support strategy
(Griffith and Alexander 2002)	Metrics should reveal important and correctable deficiencies in an organization's performance
(Melnyk, Stewart et al. 2004)	Metrics should have well articulated guidelines so that independent sources are able to derive the same metric value from the same data and process
(Folan and Browne 2005)	Metrics should be relevant to the level of the organization they are being used

Finally, in general, in terms of academia versus practitioners some have noted that the underlying different priorities of the two groups should be noted, namely that academia values the definition and validation of measures that are generalizable albeit costly to develop and/or collect, whereas practitioners operate under greater time pressures and prefer a quick and good enough measure (Evans 2004). Thus it could well be that a research question's potential answer may translate itself in value for domain practitioners, but the process by which such an answer is derived does not necessarily lend itself to day-to-day practices. Ultimately it is important to also keep in mind that "*there is no magic bullet*" (Hauser and Katz 1998) in that some criteria may seem adequate and easy to measure but have subtle implications, whereas other criteria might be more difficult to measure but enable the enterprise (or the researcher) to focus on critical decisions and/or factors for its success.

2.6.3 Framing research contribution on first two research questions

The following are key considerations in the context of this research:

- Avoid proposing another performance measurement framework and instead suggest key systems thinking criteria and metrics where appropriate, so as to complement hospitals' traditional large sets of highly specific measures.
- Recommendations on key criteria and any metrics should be informed by lean enterprise principles.
- The intended audience of our contribution is senior hospital leaders.
- Leverage existing performance measurement practices of leading hospitals, as well as those published in the literature.

2.7 Chapter 2 Summary

In this chapter we examined different theoretical perspectives on the broader concept of organizational effectiveness as well as the inherent difficulty in adopting a multi-stakeholder approach versus a profit maximization approach.

We also described performance measurement practices and systems from a multidisciplinary perspective (e.g. operations research, product development, etc) on what are some of the most common pitfalls and best practices, including the learning stemming from LAI's ongoing research on lean enterprise principles and how it can improve hospital enterprise performance measurement. Finally, we introduced the key issue of defining health care quality and performance and how these relate to an individual hospital's mission in the context of their surrounding community and society at large. We also conducted a detailed analysis on multidisciplinary literature focused on hospital performance measurement and found that traditionally there has been a focus on one or two performance dimensions, and although most recent publications advocate broader performance assessments, these are still at a conceptual level and lack empirical data. Moreover, there is sparse empirical evidence as to what extent hospitals are adopting a multidimensional perspective of performance. To that effect, in the context of this thesis it is pertinent to ask: ***How is hospital enterprise performance currently measured?***, which in turn poses our follow-on research question: ***How could hospital enterprise performance measurement be improved using lean enterprise principles?***

Having reviewed the literature both in terms of the enterprise performance literature at large, and hospital enterprise performance measurement in particular, we next examine the enterprise architecture literature. In doing so we establish that MIT's emerging NREAF is the most complete framework to inform this research. However, consistent with its nascent phase we also establish the need for its theoretical enrichment with clear constructs and operational guidelines stemming from in-depth empirical study. Ultimately, we formulate this thesis' the two remaining research questions[24].

[24] Please refer to section 1.5 for a summary of this thesis' four research questions.

3. Enterprise Architecture

As shown in Chapter 2, the study of organizational performance is historically considered to be of central importance as part of the theoretical development of different disciplines. Despite the challenges described in terms of defining and measuring performance, it was also noted that consensus exists in that rather than listing performance attributes, one ought to derive a theory about the performance of organizations. One such theory, lean enterprises, was examined in detail including a historical account of its origins, followed by the derivation of a much needed theoretical underpinning for LAI's seven lean enterprise principles. Finally, it was also noted that the adoption of such lean principles implied that one rethink the entire enterprise (Nightingale 2002).

In this chapter we conduct a longitudinal review of the pertinent organizational design and systems thinking literatures, so as to further understand what *rethinking an entire enterprise* may entail. Furthermore, we examine evidence of the relationship between performance and organizational design, including the works of Tushman and Nadler who noted that: "*A basic goal of organizational research has been to discover what kinds of organizational designs or structures will be most effective in different situations*" (Tushman and Nadler 1978). We first begin with an appreciation of studies relating organizational design and organizational performance, including healthcare and other service domains. Next we provide an overview of different organization design conceptualizations and discuss their limitations and advantages. Having identified the greater value of one of the conceptualizations we explore in detail ten of its most influential organizational frameworks to inform our research. We then introduce Enterprise Architecture (EA) from a systems thinking perspective, describe its predominant lenses, and provide a synthesis which leverages frameworks from both the organizational science and systems thinking literatures. Finally we explore how the "*theory of the business*" (or rather the Lean Enterprise Principles), is related to the conceptualization of EA, and we explain our reasoning for this thesis' remaining two research questions.

3.1 Relating Organizational Design and Organizational Performance

Both management theorists and practitioners alike are said to generally agree that an organization's design and respective environment "*make a difference in affecting organizational performance*" (Van de Ven and Ferry 1980). As such, scholars then proposed that that organizational performance could be engineered (Lewin and Minton 1986). Healthcare theorists have made similar observations as early as the 1970's as well as recently (see Table 3-1). Systems thinkers in turn have further noted that 21st century organizations derive their performance advantage from their "*ability to craft innovative combinations of systems and organizations – enterprise architectures*" (Dickman 2009).

Table 3-1: Examples of observations of design and performance relationship in healthcare

Reference	Quote
(Longest 1974)	"the results of this research show that hospital management practices have an impact on patient care as well as cost"
(Shortell 1976)	"what types of strategies and [organizational] configurations might result in better performance than others?"
(Shortell, Becker et al. 1976)	"hospital efficiency and quality of care can each be viewed as a function of the hospital's external environment, technology, and certain internal organization design variables"
(Pronovost, Jenckes et al. 1999)	"Clinicians and hospital leaders should consider the potential impact of ICU [Intensive Care Unit] organizational characteristics on outcomes of patients having high-risk operations."
(Fernandopulle, Ferris et al. 2003)	"there is convincing evidence that organizational factors can affect quality of care. This presumption is reinforced by recent studies linking nurse-to-bed ratios to hospital's mortality rates"
(Douglas and Ryman 2003)	"a hospital's internal capabilities can be used to deliver strategic competencies that result in competitive advantage [as] related to hospital cash flow"

An interesting conclusion from scholars who studied service-based organizations is that the organization as a whole has significant implications for the performance of individuals. Notably the degree of implications is dependant on where each individual is positioned within an organization's structure. For instance, in assessing performance, senior level management is ideally cognizant of a broader number of factors and implications, than those considered by front line employees.

Flood (1994) summarizes as many as five studies that suggest that the quality of care provided (i.e. a fundamental performance dimension identified in Chapter 2 Section 2.5) is best predicted by the specific hospital where care is provided rather than the qualifications and experience of the individual physician performing the work. Flood clarifies that physician's qualifications are indeed important for quality of care, but that organizational context (i.e. where the physician works) is far more important in setting upper and lower limits of performance.

Groysberg, Nanda et al (2004) derived similar conclusions when conducting an in-depth study that tracked the performance of over 1000 stock analysts as well as their career movements (i.e. whether or not they changed organization). Essentially, the authors advised organizations not to hire star performers from other organizations as these experience a performance plunge which also jeopardizes the functioning of the group or team they joined. As such, the authors emphasized that the performance of service-based organizations is not only the result of an individual's personal competencies but also of the organizational capabilities supporting the individual (e.g. systems and processes; leadership; informal network; training; teams).

Huckman and Pisano (2006) conducted a similar study tracking surgeons performing the same task (i.e. medical procedure) and determined that surgeon performance is not fully portable across hospitals. The authors recognize the hospital's organizational capabilities (e.g. systems and processes; leadership; culture; human resource policies) as a critical element influencing a surgeon's performance. However, they further make the distinction that a surgeon's own familiarity with a given organization is equally an important factor influencing performance (i.e. knowing what the inherent limitations and capabilities are and coping with them).

Ultimately, there is evidence that an organization's particular design and thus inherent capabilities, has an impact on performance at both an individual and organizational levels. Therefore, the construct of organization design may be examined from multiple levels of analysis, as was the case with the construct of organizational performance in Chapter 2,

and thus the relationship between the two constructs can mean different things to different people. Understandably, a significant limitation of such studies pertains to conceptual issues (Randolph and Dess 1984) and as a result, theories struggle with the richness of the reality of the organizations they are attempting to describe (Hall and Saias 1980).

3.2 Overview of Different Organization Design Conceptualizations

Section 2.2 of Chapter 2 described several major approaches that researchers have developed and refined when studying organizational performance. The study of organization design and its relationship with organizational performance has also warranted different conceptualizations which will next be examined.

Colbert (2004) reviews the human resources and performance literature in his characterization of three main conceptualization perspectives, namely the universalistic perspective, the contingency perspective, and the configurational perspective. Although the author derives these perspectives in the specific context of human resources (i.e. a subset of the available organization design elements one can consider), his categorization is nonetheless useful to describe theories at large.

The **universalistic perspective** follows the same "*one-best way*" mindset described in Chapter 2's Section 2.4.1 where scholars defined organizational best practices independent of an organization's particular context. An early criticism of this perspective was that of Herbert Simon (1946) who warned of oversimplified organization administrative principles (e.g. division of labor, hierarchy of authority, centralization, span of control) which supposedly deliver organizational performance without considering all the relevant organizational elements which might also have an effect (e.g. environment, structure). Similarly, criticisms were targeted at studies that attempted to study organizations by simply comparing them using a single parameter variable such as

size, age, or geographic location (Perrow 1967)[25]. Still that didn't detract scholars from pursuing universalistic theories. For instance, some human resource practices were thought to create strategic leverage for all organizations regardless of their particular context (Miles and Snow 1984). Moreover universalistic theories ignore the potential interactions effects that may exist amongst organizational elements beyond the focal phenomena of interest, and in some cases may even implicitly assume that effects of pair-wise relationships are additive. Colbert (2004) goes on to say that contributions from a universalistic perspective aren't necessarily useless, but rather of limited value.

The **contingency perspective** ascribes that relationships amongst organizational elements don't follow "*the simple, linear, causal relationships explored in universal theories and allows for interaction effects and varying relationships depending on the presence of a contingent variable*" (Colbert 2004). Early examples of the contingency perspective include the contribution by Burns and Stalker (1961) who noted that successful organizations in stable environments tended to have *mechanistic* structures (i.e. highly bureaucratic) and processes whereas those in uncertain environments tended to have *organic* structures (i.e. flexible) and processes. The contingency consideration of an organization's structure in relation to its environment was further examined by Lorsch and Morse (1974) who propose that successful organizations exhibit a *match* (i.e. congruence or fit) between their external environment and their internal environment (i.e. degree of structural differentiation). Colbert (2004) provides a more recent example of human resource management studies where human resource policies are related to organizational performance outcomes while allowing for the moderating effects of strategy. In particular, the resource based view of the firm (Barney 1991) states that organizations develop competitive advantage over time by effectively combining physical, organizational (e.g. processes, control systems), and human resources (e.g. skills, behavior, knowledge) which add unique value and are hard for competitors to

[25] Perrow (1967) was one of the first authors to argue for what would become the contingency perspective and proposed that organizations should be compared whilst taking into account their underlying technology (i.e. early denomination for "processes"). In other words, the tasks performed at an organization may be completely different than those of another organization, and even though they might have the same number of employees, their functioning and behavior is likely to be entirely different (e.g. a bank versus and R&D organization).

understand and imitate. However, the contingency perspective is said to favor the study of external and/or vertical variables (e.g. strategy) as moderating variables, and largely ignores the existence of interaction effects amongst internal system variables (e.g. structure and processes). Additionally, several contingency studies are said to lack specificity and clarity as to how they translate into higher organizational performance (Argote 1982; Venkatraman and Camillus 1984), and that an overreliance on contingency commonalities persists whilst ignoring the value of differences that may be the source of competitive advantage (Ginsberg and Venkatraman 1985).

The **configurational perspective**[26] adopts a holistic perspective of inquiry where patterns of multiple interdependent organizational variables are identified and related to a given dependent variable such as performance (Miller and Friesen 1977; Miller 1979; Miller and Friesen 1980; Miller 1981; Drazin and Ven 1985; Miller 1986; Miller 1996). The configurational perspective is different from the contingency perspective as noted by Mintzberg (1980) in that the contingency perspective related organizational performance to the fit of a given design parameter and a contingency factor, whereas the configurational perspective requires an internal consistency among several design parameters in order to derive performance or simply understand organization design. Similarly, Meyer et al (1993): "*researchers have been preoccupied with abstracting a limited set of structural concepts—centralization and formalization, for example—and measuring their relationships with a limited set of abstracted situational concepts, such as size, and technological uncertainty*". Moreover, the configurational perspective attempts to characterize internally consistent wholes (i.e. reinforcing interaction effects) and upon identifying patterns these are in turn related to organizational performance (Doty and Glick 1994). Specifically, configurational theorists were at odds with the multitude of bivariate statistics (i.e. pair-wise relationships between organizational elements) which contributed to fragmented and irreconcilable findings as these often failed to consider interaction effects from other obvious organizational elements (Miller 1981). As such, configurational theorists called for broader research scopes to better

[26] The configurational perspective has also been referred to as the systems approach of organization design (Drazin and Ven, 1985).

understand organizational complexity and "*abandon the assumptions of multivariate linearity and [instead] isolate several common patterns among the [organizational element] variables*" (Miller 1981). Moreover, scholars argued that "*a pattern analysis is needed for the interactions of multiple contingencies and structural patterns on organizational performance*" (Drazin and Ven 1985). To that effect some authors clarified that organization design should seek *alignment* (i.e. fit) between the organization and its environment, as well as *arrangement* among internal structures and processes (Venkatraman and Camillus 1984).

Table 3-2: Examples of studies of organizational element pair relationships

Pair	**Sample References**
Environment and Structure	(Burns and Stalker 1961; Lawrence and Lorsh 1967; Galbraith 1974; Miles, Snow et al. 1978)
Process and Structure	(Woodward 1965; Thompson 1967; Ven, Delbecq et al. 1976)
Strategy and Structure	(Chandler 1962; Child 1972; Miller 1993)
Strategy and Information Technology	(Chan, Huff et al. 1997; Sabherwal, Hirschheim et al. 2001)

Ultimately, the key difference across these conceptualization perspectives is the level of system complexity recognized by a given author. The universalist perspective is the most simplistic where findings are derived from organizational elements in isolation of each other, whereas the configurational perspective considers the organization as a whole and postulates that interaction effects are of central importance towards understanding organizational performance. Finally, it is important to note that studies from a configurational perspective typically examine organizational performance for the whole organization and define a single configuration (i.e. gestalt) to describe the organization as a whole.

Two additional conceptualizations, although of a different nature, are important to highlight, namely *strategic choice* and *population ecology,* as these underpin different theoretical approaches in assessing the design and functioning of organizations. The *strategic choice* view (Child 1972) asserts that the design of an organization isn't a naturally occurring phenomenon but rather the deliberate result of strategic choices made

by organizational administrators which ultimately determine an organizations' processes and structure[27]. The *population ecology* view (Hannan and Freeman 1977) assert that environmental factors directly influence an organization's overall structure, and a manager has no choice but to adapt to cope with his or her environment. Organizational managers who wish to survive must perceive and process their changing environments by gathering correct information, and then respond through the rearrangement of internal organizational structures (Astley and Ven 1983).

Similarly, Powell (1992) describes the differences between the *organizational alignment* and *competitive advantage* approaches which are indicative as to how configurational theorists may also present their own biases. The alignment approach focuses on the environment and the organization's structure, and neglects strategic positioning. In turn, the competitive advantage approach focuses on competitive strategy, and neglects the organization's internal attributes. Notably, other authors have described similar phenomena using different terminology (e.g. competitive positioning is externally focused and resource-based view of organizational resources is internally focused (Tippins and Sohi 2003)).

3.3 Leveraging Organizational Frameworks from a Configurational Perspective

In the late 1990s, MIT established the Engineering Systems Division (ESD), as a new interdisciplinary unit within the School of Engineering with the proposal that new approaches, frameworks, and methodologies were needed to design large-scale complex systems that serve society's needs (Roos, de Neufville et al. 2004). One such framework is the Nightingale-Rhodes Enterprise Architecture Framework (NREAF) (Nightingale and Rhodes 2007), currently under development at MIT, which reflects preliminary generalized results based on several years of empirical studies (Rhodes, Ross et al. 2009).

[27] An earlier influential publication was that of Alfred Chandler who professed that organizational structure followed strategy (e.g. a diversified strategy implied a decentralized structure): "growth without structural adjustment can lead only to economic inefficiency". Chandler, A. (1962). Strategy and structure. Cambridge, MA, MIT Press.

Enterprise Architecture (EA) is a concept derived from general systems theory whereby an organization is regarded as an open system comprising its context (e.g. external environment), its processes (e.g. organizational characteristics), and its outcomes (i.e. performance) (Katz and Kahn 1966). Frameworks help define boundaries, specify dimensions or views and may also provide initial intuitions into the relationships amongst views (Rouse and Putterill 2003).To that effect MIT'S NREAF adopts a holistic approach in the representation of enterprises thereby adopting a configurational perspective and not focusing only on one or two individual elements and opting to study eight views (i.e. External factors/ Policy; Strategy; Process; Organization; Knowledge; Information Technology; Product, Service).

An observation that systems thinkers often make about the organizational science literature is that it has been developed in a "*stovepiped manner [...] highly balkanized into narrowly scoped independent threads of research [and that such] is especially evident in contingency theory, which exists as a collection of often-independent observations of organizational structuring*" (Glazner 2009). Already in the early eighties some organizational theorists had called for integrative theory development given that "*different schools of thought tend to focus only on single sides of issues and use such different logics and vocabularies that they do not speak to each other directly*" (Astley and Ven 1983). In fact, experts from the medical community had also called for more integrative frameworks capable of providing an improved understanding and verifiable account of medical care organizational functioning (Scott 1993). Recently such calls have continued to surface and that "*rich, integrated theoretical frameworks will help focus and organize research efforts*" (Colbert 2004).

However, configurational theorists, who are after all also embedded in the organizational science literature, have noted that "*any research into the nature of functional and discordant response patterns to specific challenges and settings, must simultaneously consider environmental, organizational, and strategy-making dimensions.*" (Miller and Friesen 1980). Thus, the stovepipped metaphor isn't an entirely accurate characterization

of the organizational science literature as a whole. Therefore, an opportunity exists to identify and review key contributions that have adopted a configurational perspective so that these may then inform our subsequent sections on EA.

3.3.1 Clarifying what is meant by organizational framework

When reviewing the literature it is common to see that authors often use interchangeably the terms framework, model, and system (Rouse and Putterill 2003). Thus before studying the contributions of configurational theorists it is important that one clarifies what an organizational framework means in the context of this research.

Nadler and Tushman (1980) observed that the underlying complexity of the everyday life of organizations presents mysteries and apparent contradictions for which the use of a conceptual framework or model is essential to make sense of the terrain of organizational behavior. A conceptual framework presents a theory which suggests how different factors are related and how different combinations of factors can cause other factors to change. Frameworks are thus critical in guiding both researchers and practitioners in their analysis and action, including what information to collect (and consequentially what data to ignore), and how to interpret that information to determine specific problem types and causes, and ultimately support decision making in devising a course of action. Notably, the authors observe that frameworks "*vary in quality, validity, and sophistication depending on the nature and the extent of the experiences of the model builder, his or her perceptiveness, his or her ability to conceptualize and generalize from experiences, and so on*" (Nadler and Tushman 1980). Clearly, the authors emphasize the empirical component in framework building and allude to the potential issue of generalization.

For instance, two different researchers independently examining the same organization and studying a common problem (e.g. patient overcrowding in hospital emergency departments) may have considerably different approaches and arrive at different results. Whereas one researcher may choose to focus specifically inside a given service unit (e.g. emergency department), another researcher may adopt a broader perspective and also include adjacent service units that interact with the focal unit of analysis. Notably, as we

learned in Chapter 2, the latter approach is more likely to produce a better characterization of enterprise behavior. Similarly, researchers and often practitioners, may rely on a narrow characterization of enterprises (e.g. focus on processes and organizational structure) and fail to account for unique contextual aspects which may allow for different phenomena of interest to emerge and explain observed system behaviors.

Along similar lines, Clarkson (1995) considers frameworks a helpful tool for clarifying theories and abstract concepts or constructs. However, the author equally notes the issue of generalizability and calls for empirical testing to establish a framework's validity and applicability beyond mere expert opinion.

Rouse and Putterill (2003) emphasize that a distinction does exist between modeling and frameworks, in that frameworks are the essential starting point of theory development where boundaries are clarified, dimensions or views are specified, and initial intuitions into relationships among views are suggested. A framework is thus considered essential in informing models that then attempt to predict the behavior of components of interest rather than randomly selecting factors from a large pool of candidates and arbitrarily defining interactions amongst them. Similarly, and specifically in the context of healthcare scholars, frameworks are regarded as essential tools to "*help focus attention on key dimensions important for real-world application*" (Glasgow, Goldstein et al. 2004). Coincidently, others make the specific distinction between frameworks and models in that, models are mathematical and executable, whereas frameworks are representations that describe organizations or physical systems which may then lead to a model (Sussman 2010).

Reijers and Mansar (2005) offer a similar distinction between modeling and frameworks, and emphasize that frameworks present an explicit set of factors, views, and relationships, that help practitioners reengineer organizations.

An alternative framework definition is offered by Stanke (2006), a systems thinker, who

says that "*the codification of best practices and their organization into a framework can be considered an architectural design for high performance enterprises*". Other system thinkers have also alluded to frameworks facilitating the architectural design of enterprises, but adopted a definition more akin to those of configurational theorists in stating that the use of a "*framework encourages discovery of the critical relationships among elements in the enterprise [while] taking an engineering systems perspective to result in a holistic understanding*" (Rhodes, Ross et al. 2009)[28].

In the next subsections we examine 10 well cited frameworks from the organizational science literature to inform our EA research (see Figure 3-1).

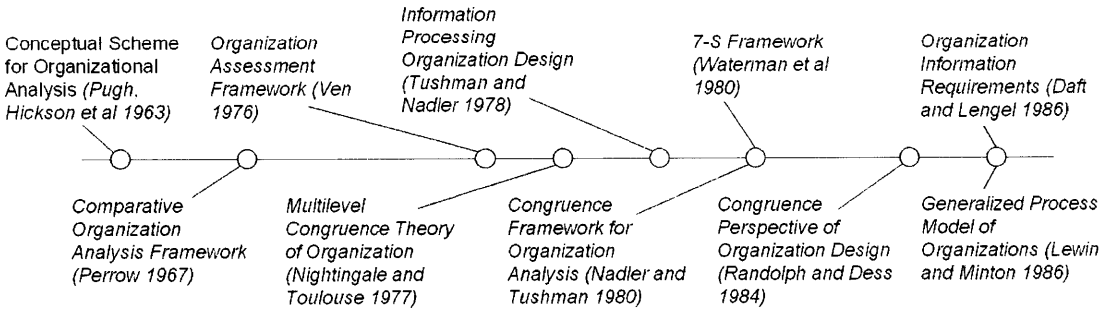


Figure 3-1: Overview of longitudinal review of organizational science frameworks

3.3.2 Early frameworks to support organizational comparison

One of the early concerns of organizational researchers was the ability to make valid generalizations from their study findings and to that effect they began thinking beyond single variable studies (e.g. comparing organizations on the basis of size determined by the number of full time employees). Additionally different scholars adopted different approaches in studying work organizations and behavior, and belonged to either of two main theoretical camps, namely the administrative and management theorists, and the empirically oriented sociologists and psychologists. The first camp is characterized as studying organizations without people, whereas the second camp is characterized as studying people without organizations, meaning that each camp had been traditionally focused on a single aspect of organizations (i.e. either organizational structure or individual interactions) without any regard for other factors. Recognizing these trends,

[28] Nightingale and Rhodes are the authors of MIT'S NREAF which will be examined later in this Chapter.

two influential publications produced the first efforts towards improving the basis of organizational comparisons.

Pugh, Hickson et al (1963) observed that often times scholars used single case studies and produced over generalizations from their findings as no account was given for contextual factors. As such, the authors proposed "*a conceptual framework for analyzing the structure and functioning of organizations [where they] conceptualize organizational structure as being made up of a number of dimensions*" (Pugh, Hickson et al. 1963). Specifically six structural dimensions are examined: (1) specialization, (2) standardization, (3) formalization, (4) centralization, (5) configuration[29], and (6) flexibility. Furthermore, the authors emphasize that organizational processes (i.e. whereby organizational functioning takes place) determine the organizational structure construct across its six dimensions. As for contextual variables the authors examine an organization's origin and history, its ownership and control, size, charter (i.e. ideology and goals), technology[30], location, resources, and interdependence. Thus, rather than advocating that organizational structure is primarily a function of one contextual variable, the authors proposed that empirical studies look at a mix of contextual variables to better understand the relationship between process and structure when comparing organizations. Moreover, the authors presented one of the earlier calls for research that distanced itself from universalistic theories, and instead adopted a contingency perspective which accounted for contextual factors and adopted more than a single dimension of organizational structure.

Similarly, Perrow (1967) considers that an organization's technology (i.e. equivalent of today's *processes* denomination) are its most defining characteristic and that it defines organizational structure. As such he proposes that first and foremost comparisons should only be made amongst organizations with similar technology (e.g. although schools and hospitals perform services of a professional nature, they are very different and such sheer

[29] Please note that *configuration* in early writings referred to an organization's particular structure (e.g. hierarchy, matrix, etc)
[30] Please note that *technology* in early writings referred to the techniques used in workflow activities in order to produce an organization's goods or services.

organization size comparisons would be inadequate). Next he suggests characterizing organizations' structure in terms of control (i.e. degree of discretion in completing a task), coordination (i.e. planned vs. feedback), and non-task related interactions (i.e. social identity such as communal values; instrumental identity such as pay and job security; goal identification such as mission; and task identification such as technical satisfaction). Finally, three types of goals are proposed to further characterize organizations, namely system goals (i.e. organization wide), product goals (i.e. product characteristics), and emergent goals (i.e. goals beyond organization's main goal and independent of any product).

3.3.3 1976: Ven's Framework for Organization Assessment

The concepts of context, process, and structure were included in Ven's (1976) framework (see Figure 3-2) intended to characterize organizations' internal functioning and performance. The goal was not only to adequately characterize organizations but also to understand how their design might affect organizational performance.

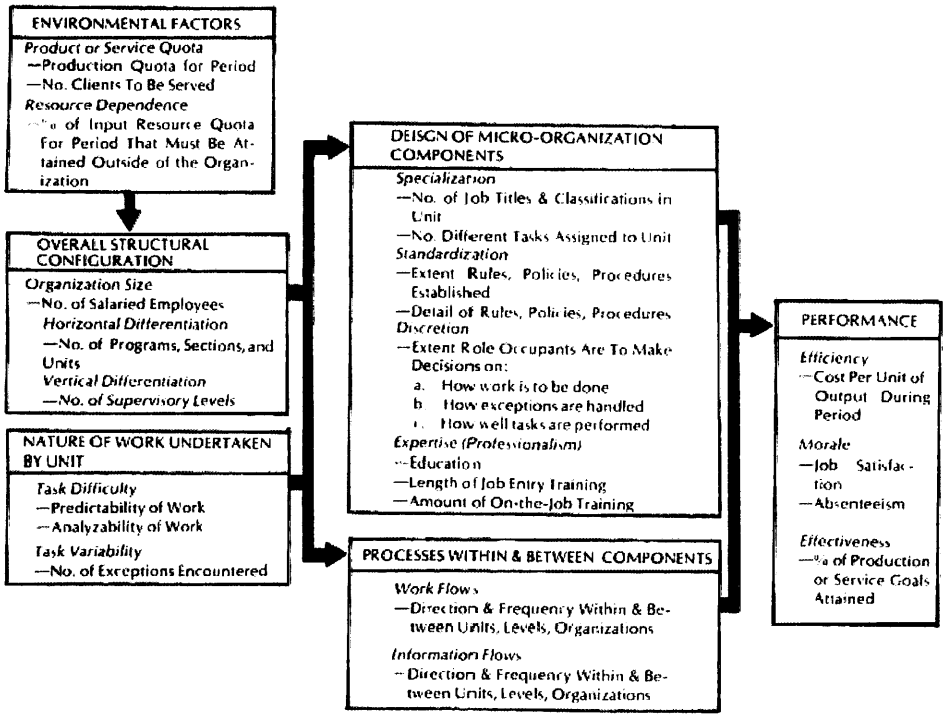


Figure 3-2: Theoretical Framework for Organization Assessment (Ven 1976)

To begin with, the author adopts a "*strategic choice*" view (Child 1972) which asserts that the design of an organization isn't a naturally occurring phenomenon but rather the deliberate result of strategic choices made by organizational administrators which ultimately determine an organizations' processes and structure[31]. Moreover, an organization's structure doesn't naturally occur and thus requires the intervention of a stakeholder in a strategy role to design the structure. However, he also admits to some extent to a "*population ecology*" view (Hannan and Freeman 1977) when recognizing that environmental factors indirectly influence an organization's overall structure, as do the inherent difficulty and variability of the organization's processes.

Next, the author observed that a "*complex organization consists of multi-forms of structurally differentiated but interdependent subsystems, each with its own structural pattern for programming a cycle of activities*" (Ven 1976). Also, he posits that "*certain patterns of structure and process of an organizational component will lead to higher performance than other patterns*" (Ven 1976). Such an hypothesis adopts an equifinality view (i.e. different design patterns may be equally effective for a given contingency), rather than "*one best way*". Therefore, when comparing organizations one needs to take into account, and indeed leverage, the existence of multiple structural forms within each individual organization as these may contribute to different levels of performance. Specifically, performance is defined as a function of goal attainment (i.e. how well the organization is meeting its internally defined objectives), morale (i.e. a function of job satisfaction and employee absenteeism), and efficiency (i.e. cost per unit of output).

Furthermore, the author calls for research that "*cuts across and links the macro (overall organization) and micro (work unit or department) levels of analyses*" (Ven 1976). Specifically, the author suggests that the linkages between the multi-forms and the macro-organizational layer allow for a greater understanding of an organization's performance. He further suggests that such linkages should become observable upon

[31] An earlier prominent publication was that of Alfred Chandler who professed that organizational structure followed strategy (e.g. a diversified strategy implied a decentralized structure). Chandler, A. (1962). Strategy and structure. Cambridge, MA, MIT Press.

inspecting the direction and frequency of work and information flows between organizational components, which in turn, may hold different design patterns.

3.3.4 1977: Nightingale[32] and Toulouse's Multilevel Congruence Theory of Organization

Nightingale and Toulouse (1977) proposed a theory of organization framework that not only includes context (i.e. environment), process, and structure, but also specifically details managerial values and the reactions-adjustments of organization members. The authors recognize that the elements of their framework aren't new but offer that their contribution is the analysis of congruency amongst the elements over time, rather than the traditional pair-wise analysis (e.g. structure and process; values and structure; etc) which they quote extensively. Additionally, similar to others (Pugh, Hickson et al. 1963; Perrow 1967; Ven 1976) the authors attest that processes are a key organizational element that sets limits on the possible variations of the system. However, the authors also clarify that such processes don't "*necessarily impose a specific, given structure to the organization [and that all elements may have] causal flows in the opposite direction*" (Nightingale and Toulouse 1977). Finally the authors' theory is that over time organizational elements move towards a state of congruency. However no assertions are made as to whether such congruency translates into enhanced performance results and no mentioning of performance is present.

3.3.5 1978: Tushman and Nadler's Information Processing Organization Design concept

Tushman and Nadler (1978) proposed a conceptual information processing model of organizations where the congruency of organizational elements translates into organizational performance (although no specific performance definition is offered). In addition to the commonly used organizational elements of environment, processes, and structure, the authors propose information processing requirements as another key design

[32] Please note that the author in this reference isn't the same author previously referenced in this thesis with the same surname. Specifically, the author in this reference is called Donald V. Nightingale, whereas the author previously referenced is called Deborah J. Nightingale.

element to consider. Notably the authors build on the work of Galbraith (Galbraith 1974) which first proposed an information processing view of organizations.

Similar to Ven (1976) the authors adopt a macro level as well as a subunit level of analysis and argue that multiple structural configurations may exist within the same organization, and that each configuration may deliver different levels of performance. As an example the authors explain that an intensive care nursing subunit is faced with significantly greater information processing requirements than does a rehabilitation-oriented nursing subunit which is presented with more routine tasks that aren't as interdependent. Thus, different configurations are appropriate to accommodate different levels of subunit uncertainty, task complexity, and inter-unit task interdependence. Moreover, subunits with higher uncertainty and/or interdependence require more complex coordination mechanisms (e.g. joint planning and troubleshooting) than do less turbulent and/or isolated subunits that need only apply simple coordination mechanisms (e.g. rules and hierarchy).

The authors argue that "*high performing organizations are those which match [information processing] capacity to [information processing] requirements [and that a] mismatch in capacity and requirements should be associated with lower organizational performance*" (Tushman and Nadler 1978). However, contrary to Ven's (1976) top-down approach (i.e. first examine macro organizational level and then subunit level), Tushman and Nadler propose that analysis should begin at the subunit level, followed by inter-unit level, and finally macro level.[33]

[33] MIT Professor Joel Moses has been quoted using the term "*middle-out*" in describing how managers (top-down) and frontline employees (bottom-up) come together to deliver an enterprise's value proposition. In: Costa, I. and P. Ferrão (2010). "A case study of industrial symbiosis development using a middle-out approach." Journal of Cleaner Production **18**(10-11): 984-992.

3.3.6 1980: Nadler and Tushman's Framework for Understanding Organizational Behavior

Nadler and Tushman (1980) published yet another influential article in which they proposed a general framework[34] for thinking about the organization as a total system rather than to address a specific problem (e.g. how to motivate employees; how to improve innovation; etc). The authors argue that systems thinking is a useful concept to understand organizational behavior but that a specific and pragmatic framework is needed. They identify as critical system characteristics: *internal interdependence*, *capacity for feedback* (i.e. output information can be used to control the system), *equilibrium* (i.e. systems apply energy to reach a state of balance), *equifinality* (i.e. different system configurations can lead to the same end), and *adaptation* (i.e. a system must adapt to environmental conditions to survive and thrive).

Similarly to Nightingale and Toulouse (1977), the authors emphasize the internal interdependence system property in that congruence (i.e. how well organizational elements fit together) translates in enhanced performance results, and the lack of it leads to problems, dysfunctions, or performance below potential (see Figure 3-3). Specifically, performance is defined as a function of goal attainment (i.e. how well the organization is meeting its internally defined objectives), resource utilization (e.g. are resources being *burnt-up* or further developed?), and adaptability (i.e. is the organization improving its market position?).

[34] The authors use the terms framework and model interchangeably.

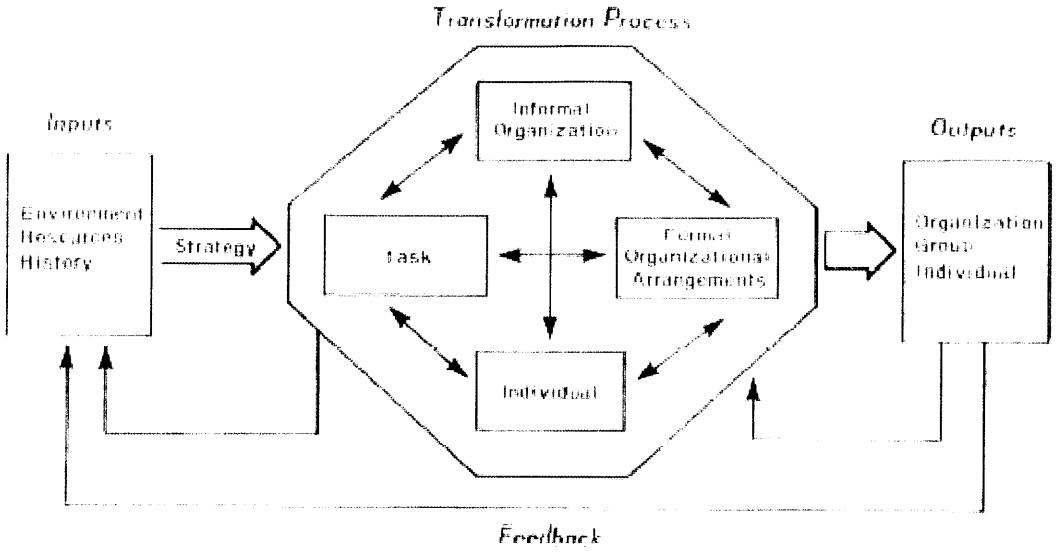


Figure 3-3: Congruence Framework for Organization Analysis (Nadler and Tushman 1980)

As before the authors integrate the commonly used organizational elements of environment, processes, and structure, however they also include an organization's strategy (i.e. as defined by these authors: core mission, tactics, and performance objectives), resources (e.g. human resource knowledge; stored information), and history (i.e. past events greatly influence current organizational functioning). With regards to structure an important distinction is introduced as the authors elaborate on the differences between informal (e.g. leader behavior, unspecified relationships, etc) and formal (e.g. hierarchy, rules, etc) organizational arrangements, which had traditionally been lumped together in other scholarly work.

In reading the authors' assertion that "*strategy may be the most important single input for the organization*" (Nadler and Tushman 1980) it is implicit that they follow the previously described "strategic choice" view (Child 1972). However, worth also noting is that they explicitly include a feedback mechanism whereby performance outputs, as well as processes and structure, affect the organization's environment, resources and history, and may imply that strategy be adapted to reflect these results and/or constraining factors, and in turn once again adjust organizational structure and processes.

3.3.7 1980: Waterman et al's 7-S Framework

Waterman et al. (1980), management consultants from a prominent firm, published an interesting conceptual article[35] that begins with the assertion that mainstream businesses have an inadequate understanding of organization as they traditionally think of it only in terms of structure. Notably, the frameworks described so far in this section were published earlier and already ascribed that organizations should be analyzed beyond their structural element. Similarly, the 7-S framework (see Figure 3-4) adopts the previously noted ideas of examining multiple organizational elements and that these in turn are all interconnected in such a way that significant progress in one element would require making progresses in other elements as well (i.e. similar to the notion of fit/alignment/congruency).

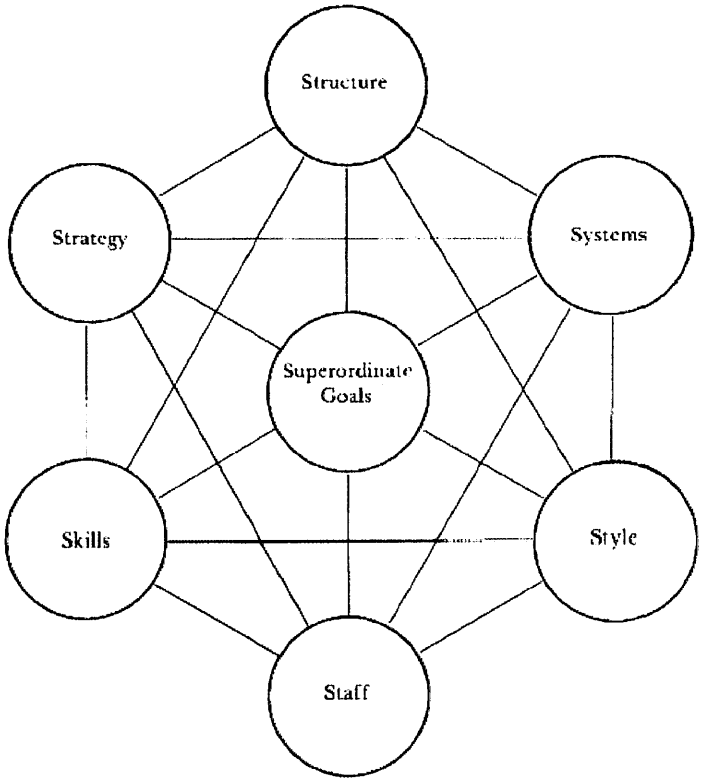


Figure 3-4: 7-S Framework for Organization Change (Waterman Jr, Peters et al. 1980)

[35] The article was later expanded into a book format: Peters, T. J. and R. H. Waterman (1982). In search of excellence : lessons from America's best-run companies. New York, NY, Harper & Row. Later Van de Ven in his book review (1983) stated that the authors had "*provided a rich and valuable source of qualitative stories, vignettes, and paradoxes that administrative scientists need to begin to take into account. That alone makes this book a significant contribution to advancing administrative science.*" Ven, A. H. V. d. (1983). "Review: In Search of Excellence: Lessons from America's Best-Run Companies. by Thomas J. Peters; Robert H. Waterman, Jr." Administrative Science Quarterly **28**(4): 621-624.

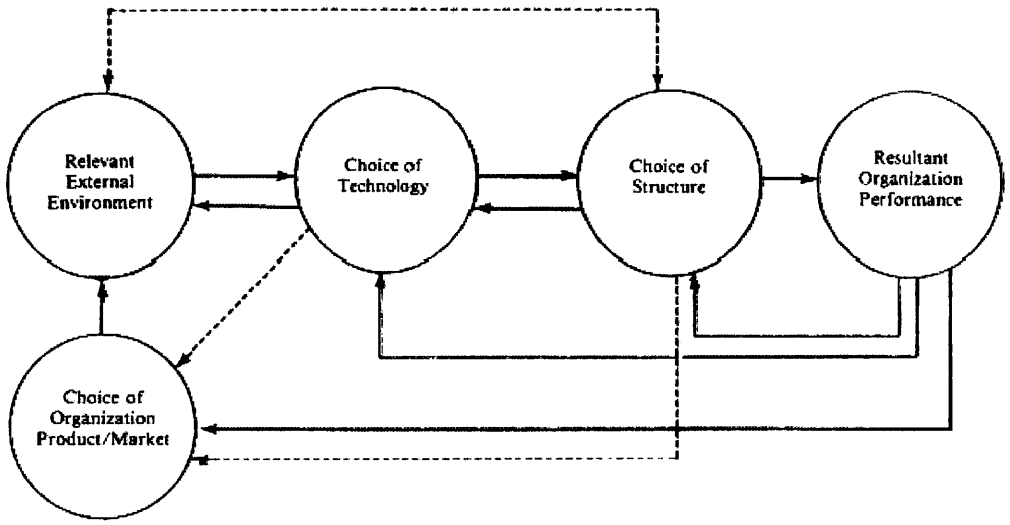
Nonetheless, worth noting is the authors emphasis that the organizational elements have no implied hierarchy or starting point for organizational analysis and/or change. Instead the authors argue that depending on the organizational context one might have to start with strategy (i.e. which would be in line with the "strategic choice" view) or that systems or structure might be more important in driving organizational change. In fact, the authors propose that organizational systems (processes and equipment as per their definition) "*threatens to dominate the other [organizational elements]*" (Waterman Jr, Peters et al. 1980).

Furthermore, the authors specifically introduce differentiated organizational elements of style and staff which previously were lumped together as "*individual*" (Nadler and Tushman 1980). Style is concerned with whether an organization's leadership style is accepted by the underlying culture. Staff is assessed on a spectrum of variables ranging from hard to soft, namely on one end, appraisal systems, pay scales, and on the other end, morale, motivation, and behavior. Conversely, unlike previous frameworks, strategy and external environment are lumped together as organizational decision makers make sense of their markets and plan accordingly.

Additionally, the framework includes "*Skills*" as a means of capturing an organization's core capabilities in delivering a product and/or service, which may present obstacles for improvement initiatives (e.g. a prevailing manufacturing mentality versus an enterprise perspective). Finally, the authors provide visibility to "*superordinate goals*" which constitute the often unwritten guiding concepts of values and aspirations that go beyond conventional formal statements of corporate objectives. Furthermore, the authors explain that a manager's goal is to attain organization effectiveness but they don't offer any definition for it and instead caution that "*the few at the top seldom agree entirely on the goals of their enterprise, let alone on maximization against one goal*" (Waterman Jr, Peters et al. 1980).

3.3.8 1984: Randolph and Dess' Congruence Perspective of Organization Design

Randolph and Dess (1984) provided an organization design literature integrating framework, which adopts a congruence perspective and explicitly includes both a "*strategic choice*" view and a "*population ecology*" view whilst examining the relationships among environment, strategy, process, and structure. The authors also include feedback control loops not only in terms of a design's resultant organizational performance, but also the potential resistance and/or difficulties in transforming processes and/or structures (see Figure 3-5).



[a]Solid lines represent direct and more important linkages; dashed lines represent less direct linkages.

Figure 3-5: The Congruence Model of Organization Design (Randolph and Dess 1984)

In terms of performance the authors don't offer a specific definition but recognize the need for a multidimensional construct which includes both financial and non-financial measures, and recommend using if possible both objective and perceptual measures. Finally, the article is a conceptual contribution but offers a recommendation for operationalizing a research study aimed at studying the relationship between congruency of organizational elements and organizational performance, namely that it should be empirically based given the richness of organizations' contextual data.

3.3.9 1986: Daft and Lengel's Organization Information Requirements

Daft and Lengel (1986) published a highly cited article[36] in which they leveraged the information processing organization design concept (Tushman and Nadler 1978) and offered a higher granularity in examining information richness and structural designs. Once again the conceptual article adopted the multi-organizational element and congruency view of organizational design. However, in terms of structure, process, and environment, it went beyond merely suggesting that a relationship existed, and did in fact suggest specific alternative structural characteristics which should be used in different settings.

To begin with, the authors argued that having more data available to managers does not necessarily translate into less uncertainty given that the data may be unclear (i.e. degree of equivocality). In other words they disagree with studies that regard structure and process as congruent merely because a frequent data flow takes place between them. As such the authors conceptualized the information role of structural characteristics for reducing equivocality or uncertainty (e.g. the use of rules and regulations where information needs aren't as rich and uncertain vs. the use of group meetings where a significant degree of information equivocality may be present) and also examined the impact of departmental characteristics (i.e. degree of similarity of processes and degree of interdependence between departments).

Finally, although the framework also considers an organization's environment (i.e. higher environmental turbulence requires an organic structure, whereas lesser turbulence can leverage a mechanistic structure), as with Tushman and Nadler, no mention is made regarding an organization's strategy or mission and how these might relate to the remaining organizational elements. Additionally, a specific definition of organizational performance isn't offered and any allusion to it is kept at a task level (e.g. did the process meet the manager's expectations [whatever these may be]?).

[36] 4112 citations on google scholar as of 30th September 2010

3.3.10 1986: Lewin and Minton's Generalized Process Model of Organizations

Lewin and Minton (1986) "*propose a research approach utilizing a strategy of engineering organizational effectiveness*" which is captured in their generalized process model of organizations (see Figure 3-6). As before, the authors characterize organizations as being comprised of multiple organizational elements, including environment, processes, structure, and strategy. However, the authors additionally suggest some specific constructs for all of the organizational elements (i.e. not just those associated with structure such as division of labor, role definition, etc).

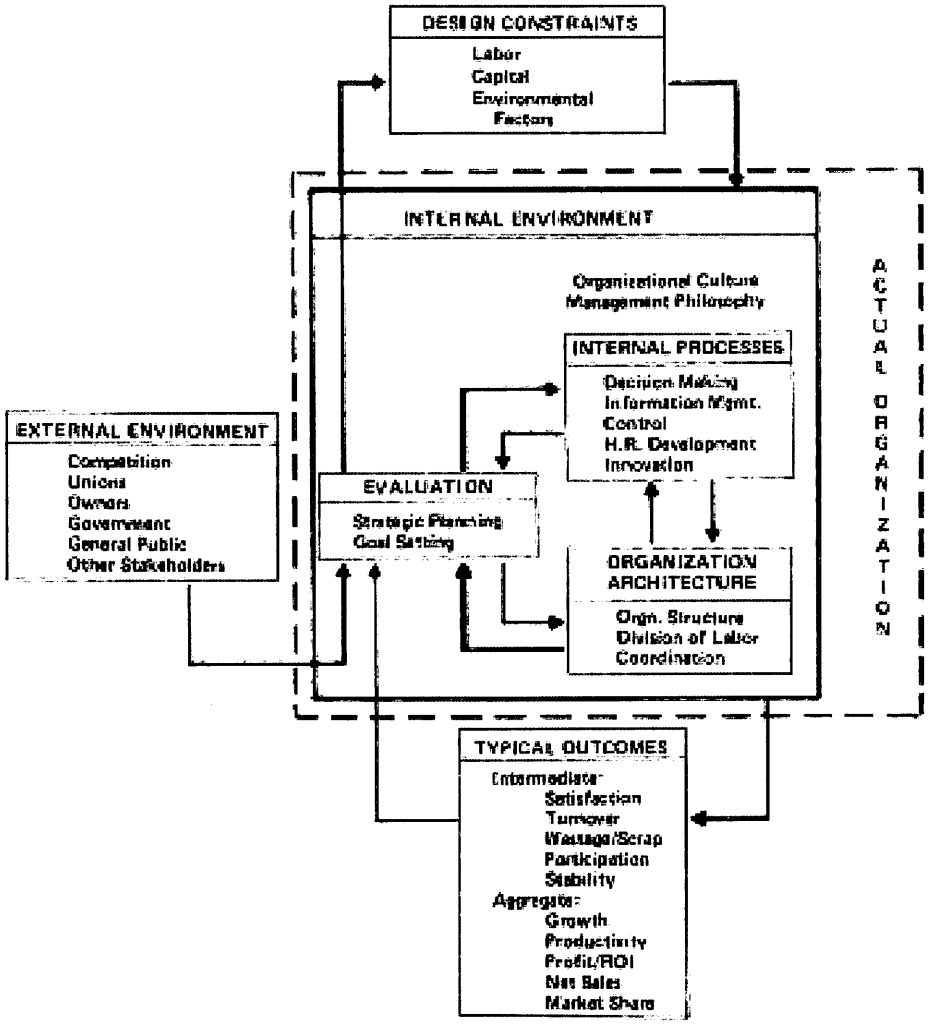


Figure 3-6: A Generalized Process Model of Organizations[37] (Lewin and Minton 1986)

[37] Interestingly the authors are one of the first to use the term "architecture" in an organization design context; however their description of architecture only includes the traditional components of structure.

In adopting a contingency theory approach and in recognizing performance as a multidimensional construct, the authors assert that different organizational designs present different performance tradeoffs. As an example one can consider the different design implications from the different requirements espoused by information processing theories (e.g. organizational performance is a function of information processing capacity) and the systems resource approach (e.g. organization's ability to acquire scarce and valued resources from the environment). The former may require an assortment of team meetings and standard rules, whereas the latter may require specific and/or additional resources at scanning the environment for more resourcing opportunities or potentially renegotiating existing contractual relationships.

As such the authors recommend that researchers adopt an empirical approach in determining whether or not specific organization designs are indeed more appropriate for certain organizational performance criteria. Furthermore, such an approach could address "*the relatively little published empirical work [on] the implied causality between organization designs and effectiveness outcomes*" (Lewin and Minton 1986). Others had already expressed similar views and requested "*very intensive and very thorough case studies*" (Campbell 1977) to explore the same relationship. Moreover, rich descriptions made available through the case method would allow one to leverage the multi-organizational element perspective on organization design while describing the relationships amongst them in a holistic[38] fashion rather than adopting the predominant pair-wise descriptions.

3.3.11 Summary Analysis of Organizational Assessment Frameworks

By the mid eighties the organization design literature was converging on several fronts. First, organizations should be conceptualized as open-systems comprised of several organizational elements, which most commonly included structure, process, strategy, and environment. Second, the alignment, fit, or congruency amongst organizational elements translates into higher organizational performance, thus scholars should look beyond mere

[38] Which is consistent with LAI's Lean Enterprise Principle 1 described in section 2.4.5.

"*pair-wise*" relationships and explore organizational elements holistically. Third, organization design should reflect the "*strategic choice*" and "*population ecology*" views, as well as potential inertia emerging from existing organizational processes and structures. Fourth, organizations are comprised of multiple internal configurations which may generate different levels of organizational performance in different parts of the same organization.

The reviewed organizational assessment frameworks also commonly share opportunities for further theoretical and empirical development in that they are only conceptual in nature and seldom specify constructs for each of their organizational elements. For instance, the authors refer to similar theories when describing the interactions among organizational elements but the reader is left with interpreting and defining constructs if he or she were to attempt operationalizing an empirical study. Furthermore, although the importance of congruence beyond "pair-wise" organizational element relationships is noted, the authors fail to characterize, or even conceptualize, the implications of adopting such holistic perspective. Finally, although these frameworks merit the relationship between organizational design and organizational performance, most of them have several of the limitations described in Chapter 2 (e.g. definition of performance in terms of goal attainment) and/or adopt narrowly defined hypothesis of performance (e.g. performance is described only as a function of information processing capability).

3.4 Enterprise Architecture

Over the course of the PhD, the author benefitted from the opportunity of being Teaching Assistant for Prof. Deborah Nightingale's graduate course "*Integrating the Lean Enterprise*" listed in both the engineering and management course catalogues at MIT. The course is primarily focused on breaking traditional mindsets of lean and allowing students to appreciate the requirements and benefits of following lean enterprise principles[39]. The last lecture of the course introduces the concept of Enterprise

[39] Chapter 2's in-depth longitudinal literature review also reflects this approach, in that it describes lean from its origins towards the latest thinking of lean enterprise principles.

Architecture (EA) as the natural follow-on step. When asked about the meaning of EA, without fail every year, students described EA from an Information Technology (IT) perspective explaining that it is a way of relating data, systems, and software. This notion isn't necessarily inaccurate, but it is incomplete and does speak to the existence of a prevalent EA perspective which isn't the same as the one followed in this research. As such, in this section we begin by examining the origins of EA from its IT perspective, and we contrast it with the broader conceptualization of EA adopted by MIT's Lean Advancement Initiative (LAI). However, in accord with what our review of the organizational science literature uncovered in the previous section, we compare and contrast MIT'S NREAF with the most influential frameworks proposed by configurational theorists of the past four decades. Finally, an appreciation for the inherent difficulties of EA research is provided along with specific research methods recommendations offered by leading scholars in the field.

3.4.1 The IT lens of EA

Several systems thinkers (Rhodes and Nightingale 2008; Glazner 2009; Lankhorst 2009; Rhodes, Ross et al. 2009) have attributed the beginnings of EA to John Zachman (1987) who as an engineer at IBM developed a framework for information systems architecture. Zachman recognized that information system implementations were increasing in size and complexity, and along with the prevalent system failure and/or inefficiency rates the author proposed a descriptive framework "*for defining and controlling the interfaces and integration of all the components of the system*" (Zachman 1987). By system the author refers to the underlying infrastructure (e.g. computers, servers, etc), software (e.g. databases, applications, etc), programming languages, and data. Also, by the author's own admission the framework's scope doesn't include business strategy as it is considered an independent concept from that of information systems.

Interestingly, although the IT lens of EA revolves around information and information infrastructure, no consideration is given to the earlier writings from organization science's literature on the information processing view of organizations (Galbraith 1974; Tushman and Nadler 1978). In essence, the two fields developed independently of each

other.

Lankhorst (2009) presents one of the most recent EA contributions that still adopts an IT perspective (e.g. describing object-oriented programming and modeling languages; discussing the issue of semantics and shared ontologies in enabling data and system interoperability; etc). However, the book's last chapter is duly entitled "*Beyond Enterprise Architecture*" and the author recognizes that EA is fundamentally "*a holistic approach to the design of organisations [which include different domains of] organisation, information, systems, products, processes, and applications [and that] we have to look at this from both a business and technical perspective*" (Lankhorst 2009). Notably the author recognizes that the inclusion of components beyond IT is not only complicated in terms of understanding each component individually but also in terms of the potential interdependencies amongst them. Ultimately, the author explicitly notes that EA "*is progressively seen not just as a tactical instrument for designing an organisation's systems and processes, but as a strategic tool for enterprise governance.*" (Lankhorst 2009). Interestingly, the author offers an explanation as to why EA has predominantly had its IT centric view, namely that the failures of applications and systems are immediately visible (e.g. Microsoft's failures highly popularized by its "*blue screen of death*" (Garfinkel 2005)) and it is easier to blame the computer rather than an intangible business process.

3.4.2 The Strategic Advantage IT lens of EA

Around the same time that Zachman produced EA's IT lens framework several researchers at MIT's Sloan School of Management were beginning to enlarge the boundaries of their problem statement.

Notably, Madnick and Wang (1988) set the foundation for a theory of Composite Information Systems (CIS) which argued for a mindset shift from designing IT merely as a support function (e.g. code, databases, applications, systems) to one of strategic importance. Successful organizations were those capable of carefully selecting the right mix of strategic applications, technology, and organizational responses. Although the

authors also mainly adopted an IT lens, they were one of the first to bring attention to the need for linking strategy, IT, and organizational context when planning and managing information systems.

The linkage between IT and organizational processes was further emphasized in an influential article by Michael Hammer (1990), who identified himself as president of an IT consulting firm. Hammer noted that IT investment was failing to meet expectations as it was simply being used to automate and speed up existing processes thereby not addressing their "*fundamental performance deficiencies*". Hammer brought into perspective the need to consider reengineering an enterprise's processes, ridding them of their inefficiencies, and only then using IT to automate the newly designed processes.

The need for linkage then progressed to a need for "*alignment between the business and IT strategies of organizations*" (Henderson and Venkatraman 1999) thereby implying that both a technical and overall enterprise strategy should exist. The authors state that no single IT application, no matter how sophisticated it may be, can deliver an organization with sustained competitive advantage. Instead, the authors follow a conceptualization consistent with the strategic choice view of organization design and claim that value from IT investments can only be enabled when strategic fit between market positioning and administrative structure (i.e. skills, processes, organization) is in place. However, once again the use of architecture is IT-centric as evident in the following definition: "*portfolio of applications, the configuration of hardware, software, and communication, and the data architecture that collectively define the technical infrastructure*" (Henderson and Venkatraman 1999). Nonetheless, the authors make a useful distinction between strategic integration (i.e. bidirectional alignment of business and technical strategies) and operational integration (i.e. bidirectional alignment of business processes and organization with IT infrastructure and processes). Finally, the authors emphasize that there isn't a best alignment perspective (i.e. otherwise everyone would mimic it and it wouldn't be strategic) and that there isn't a predefined starting point in designing an organization.

The next evolution in the strategic advantage IT lens was evident in the change of terminology from *IT Architecture* to *Enterprise IT Architecture* (Ross 2003). The author first begins by noting how infrastructure and architecture are often used interchangeably as evident in Zachman's framework which "*does not help distinguish the relative importance of processes. The output of the architecture process is often volumes of detailed drawings that are overwhelming in their volume and scope [... as] a result of the architecture function being buried in lower levels of the IT organization*" (Ross 2003). Such is a useful characterization of the traditional IT lens of EA but yet again it also reveals that this contribution is concerned with the IT organization, albeit from a more abstract level. Similarly to Madnick and Wang (1988) the author proposes that organization design should begin with defining an organization's strategic objectives. Also, similarly to Henderson and Venkatraman (1999) the author notes the need for the mutually reinforcing alignment of key IT capabilities with business strategy in order to enable the business strategic objectives. However, Ross introduces the concept of organizational learning to describe how organizations' have different levels of architectural maturity (i.e. application silo architecture -> standardized technology architecture -> rationalized data architecture -> modular architecture) and that they must continuously build their competency in order to sustain or evolve in their maturity. Finally, the author briefly mentions an important observation that "*complex organizations have multiple architectures, which may be at different stages [of architectural maturity]*" (Ross 2003) and that these reflect different organizational structures and different objectives. More recently Ross has adopted the term *Enterprise Architecture* but her conceptualization still remains IT centric as evident in the following definition: "*Enterprise architecture is the organizing logic for business processes and IT infrastructure, reflecting the integration and standardization requirements of the firm's operating model*" (Ross 2006).

3.4.3 The Lean Enterprise lens of EA

When examining both the Strategic Advantage and the traditional IT lenses of EA (i.e. the two previous subsections) it is clear that several merits exist in their contribution to the study of the relationship between organizational design and organizational

performance. As with the frameworks from the configurational perspective, the Strategic Advantage IT lens is holistic in examining organizations beyond a single element (e.g. IT, strategy, organization) and also identifies the importance of fit or congruence amongst mutually reinforcing elements in order to attain higher performance, or rather, better outcomes from IT investments. Moreover, the arrangement among internal organizational design elements, if done in a way that they reinforce each other, is thought to enable an enterprise with higher performance. However, by applying the 1st lean enterprise principle (described in Chapter 2 Section 2.4.5) it is also clear that although such lenses are holistic they aren't holistic enough as they fundamentally remain IT centric and don't allow, for instance, for organizations to be characterized without IT as an element. For instance, earlier writings from organization science's literature on the information processing view of organizations noted that "*providing inappropriate information sources to participants in work units [...] could lead to decision errors within the organization*" (Daft and Macintosh 1981) and suggested that different types of problems may require different types of organizational structures (e.g. cross disciplinary teams; face-to-face meetings; etc) supporting different processes (i.e. routine vs. non-routine) which may or not have any use of IT.

Furthermore, the IT lenses exclusively focus on the processes and strategic objectives that directly pertain to the IT capability, and ignore an organization's remaining characteristics thereby lacking an enterprise management perspective. Understandably, they have been adequately categorized as IT lenses of EA (Nightingale and Rhodes 2004; Nightingale and Rhodes 2007; Rhodes and Nightingale 2008; Nightingale 2009; Rhodes, Ross et al. 2009). Also, as previously noted, the work of Hammer (Hammer 1990) raised the awareness of redesigning processes before attempting to introduce IT to automate organizations. However, those following the school of Business Process Reengineering (BPR) have also recently recognized that BPR efforts themselves have been narrowly focused at the process level and that these should also include "*organizational structure, people, communication and technology*" (Reijers and Liman Mansar 2005). A similar observation was made by MIT systems thinkers who also explained that although

numerous EA frameworks exist (e.g. DoDAF, TOGAF, etc[40]), these "*frameworks are overly complex and emphasize an aggregated rather than holistic architecture*" (Rhodes, Ross et al. 2009). Thus, the meaning of holistic pertains not only to an enlarged number of views used in the framework but also to an "*understanding of the interactions of the views [which] becomes of increased importance*" (Rhodes and Nightingale 2008). However, the authors also emphasize that the framework should remain simple enough to support effective decision making given the cognitive limitations of decision makers. Such is akin to Porter's call for a clear intellectual framework capable of guiding strategy and informing decision makers about choices and tradeoffs in organizations (Porter 1996).

Recognizing that an enriched view of EA was necessary, researchers at MIT adopted a systems perspective and began conceptualizing a framework with eight views: Policy/ External factors; Strategy; Process; Organization; Knowledge; Information Technology; Product, Service (see Figure 3-7 and Table 3-3).

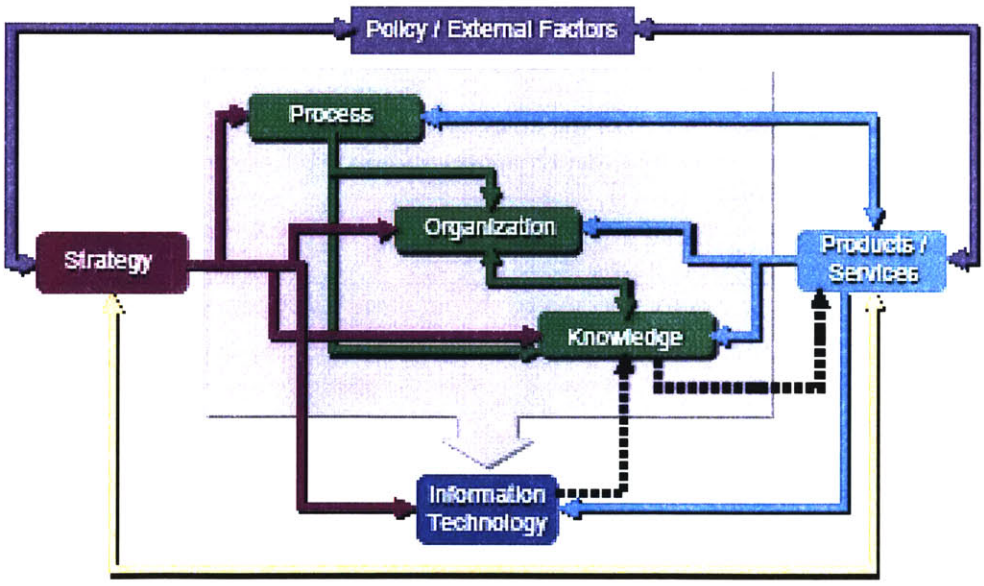


Figure 3-7: A Holistic Enterprise Architecture Framework (Nightingale and Rhodes 2007)

[40] The authors quote Schekkerman, J. (2004). How to survive in the jungle of enterprise architecture frameworks : creating or choosing an enterprise architecture framework. Victoria, B.C., Trafford.

Upon inspection it is clear that the framework leverages the earlier definition of lean enterprises as "*complex, highly integrated systems comprised of processes, products, organizations, and information, with multifaceted interdependencies and interrelationships across their boundaries*" (Nightingale 2002). The framework itself represents preliminary generalized results from several years of empirical studies and should be adapted to the specific context of each enterprise under analysis (Rhodes, Ross et al. 2009).

Table 3-3: Enterprise Architecture Views (Nightingale 2009)[41]

EA Views	Description
Strategy	Strategic goals, vision and direction of the enterprise including the business model; enterprise metrics and objectives
Policy / External	The external regulatory, political and societal environments in which the enterprise operates.
Process	Core leadership, lifecycle and enabling processes by which the enterprise creates value for its stakeholders.
Organization	The organizational structure of the enterprise as well as relationships, culture, behaviors and boundaries between individuals, teams and organizations.
Knowledge	The implicit and tacit knowledge, capabilities, and intellectual property resident in the enterprise.
Information	Information needs of the enterprise, including flows of information as well as the systems and technologies needed to ensure information availability.
Product	Product(s) developed by the enterprise; key platforms; modular vs. integral architectures, etc.
Services	Services(s) delivered and or supplied by the enterprise, including in support of products.

MIT's NREAF is an abstract representation of an enterprise and provides an approach for understanding and analyzing the "*as is*" state of an enterprise, as well as study various alternative changes and proposed interventions (Rhodes and Nightingale 2008) in the process of architecting the enterprise future state to attain its value proposition and desired behaviors (Nightingale and Rhodes 2007; Rhodes, Ross et al. 2009).

[41] By inspection, Nightingale's 2009 publication reflects a key theoretical maturation of one MIT'S NREAF views. Specifically, Figure 3-7 illustrates a 2007 reference of MIT'S NREAF where one its EA views is designated as "Information Technology", whereas in Table 3-3, a 2009 reference, it reads as a broader concept of "Information".

The relationships and associated directions amongst EA views reflect the EAF authors' recommendations as to how enterprises should be architected or designed to reach their desired future state. Specifically, "*some views drive or determine the architectures and the required attributes of other views*" (Nightingale 2009). Notably, strategy is considered to be the primary view and drives process, organization, and knowledge. In turn, the process architecture is suggested as a driver in defining the organizational architecture. The IT view is driven by almost all other views (except the Policy / External Factors view) and indirectly influences the Knowledge view. Finally, reciprocal view relationships are also suggested and explained in the case of Strategy and Products/Services (i.e. strategy determines whether to follow a modular vs. integral product architecture, and in turn, the product architecture may help the enterprise achieve competitive advantage).

3.5 Leveraging EA Systems Thinking and Organizational Science literatures

The EA Systems Thinking and Organizational Science literatures often allude to their work being more of an art or craft rather than a science. For instance, Van de Ven and Ferry (1980) noted that organizational assessment frameworks provide few process guidelines on the different steps required in assessing an organization, and that a researcher is forced to learn by trial and error. Similarly, systems thinkers have considered the design of business enterprises more of an art than science given the inherent difficulty of understanding and predicting enterprise behaviors stemming from the various EA view interactions (Rhodes and Nightingale 2008; Glazner 2009). Furthermore, systems thinkers have stated that there isn't a "*universally agreed upon set of [EA] views that can completely specify an enterprise, or even [agreement on] how many views are required to describe it completely*" (Glazner 2009).

Perhaps for these reasons, some authors have observed that frameworks "*vary in quality, validity, and sophistication depending on the nature and the extent of the experiences of the model builder, his or her perceptiveness, his or her ability to conceptualize and*

generalize from experiences, and so on" (Nadler and Tushman 1980). However, in general, frameworks have been found lacking if they are unable to develop beyond very high level descriptions of variables with unclear operational definitions (Pugh, Hickson et al. 1963), and neglect to build on well informed theory which allows to draw distinctions and relationships of conceptual significance (Miller 1996). For instance, this chapter's Section 3.3 already illustrated an example of a common mischaracterization of the organizational science literature when systems thinkers have considered it to be stovepipped as a whole, thereby neglecting the contributions of configurational theorists mentioned in the same section. Furthermore, contingency theorists, configurational theorists, and indeed systems thinkers have often used words such as fit, congruence, alignment, and holistic, which in the absence of clear descriptive guidelines make it difficult to compare and operationalize their contributions (Venkatraman 1989).

Notably, MIT'S NREAF is in its nascent phase of development (Nightingale 2009) and its authors have noted that they are capable "*at best [to] cite heuristics and emerging principles on how enterprises should be architected [so that they] can most effectively produce its desired outcome*" (Rhodes and Nightingale 2008). As such, and as stated in Chapter 1, one of the main motivations of this research is to theoretically enrich MIT's NREAF[42]. To that effect, what follows is a synthesis of Section 3.3's in-depth literature analysis of organizational frameworks from a configurational perspective while leveraging MIT's NREAF EA views.

Table 3-4 includes the ten organizational science frameworks described previously[43], which ranged from as early as 1963 to 1986, and accumulated close to 8000 citations[44]. While these authors don't necessarily list all of the EA views individually and/or give them the same name, their framework descriptions warrant an interpretation as depicted on Table 3-4. For instance, earlier authors refer to *technology* instead of *process*, and similarly to *structure* instead of *organization*. Similarly, Tushman and Nadler's (1978)

[42] As was the case with the theoretical enrichment of the 7 Lean Enterprise Principles (See Chapter 2 Sections 2.4.1 and 2.4.6) which followed the recommendation of supporting expert opinion with both empirical evidence and theoretical underpinning.
[43] See section 3.3.
[44] On google scholar as of 12th October 2010.

organizational conceptualization does not include *information* in their visual representation, but it is clearly embedded in their conceptualization as it derives from the information processing theory. Ultimately, Table 3-4 allows one to clarify that these contributions from configurational theorists don't warrant the stovepipped metaphor as they aren't necessarily IT centric or centric on any other view for that matter, and they equally call for holistic organizational designs to derive higher performance.

Table 3-4: NREAF Synthesis of Organizational Frameworks from a Configurational Perspective

	NREAF Views						
Reference	Policy / External	Strategy	Process	Organization	Knowledge	Information	Service/ Product
(Pugh, Hickson et al. 1963)	x	x	x	x			
(Perrow 1967)		x	x	x			
(Ven 1976)	x	x	x	x	x	x	
(Nightingale and Toulouse 1977)	x		x	x			
(Tushman and Nadler 1978)	x		x	x	x	x	
(Nadler and Tushman 1980)	x	x	x	x	x		
(Waterman Jr, Peters et al. 1980)	x	x	x	x			
(Randolph and Dess 1984)	x	x	x	x			
(Daft and Lengel 1986)	x		x	x	x	x	
(Lewin and Minton 1986)	x	x	x	x			

Similarly, denoting the configurational perspective, several of the frameworks emphasize the importance of studying interactions amongst organizational elements (i.e. EA views). Unlike the NREAF which mainly adopts a "*strategic choice*" approach to enterprise architecture, several of the frameworks on Table 3-4 adopt both a "strategic choice" and "*population ecology*" views. For instance, they elaborate in detail on how an organization's structure may resist or even invalidate a given strategy if it isn't supported by adequate incentive mechanisms or if it clashes fundamentally with the underlying culture, among other reasons. Similarly, they propose that an organization's structure may directly influence its external environment without such an interaction being

necessarily part of the organization's strategy (e.g. participation in professional societies; regulatory boards; board of directors; etc). Likewise, they emphasize how regulatory changes can have a direct impact on organizational processes and structure, which only later become common knowledge to strategy planners (e.g. mid level management have autonomy to adjust to environment changes without requiring detailed scrutiny or execution plans from central headquarters). Others go as far as saying that all organizational elements connect with each other and that the starting point of analysis varies with each enterprise context. Also, looking back at the Strategic Advantage IT lens of EA, Ross (2003) goes as far as saying that IT not only influences organization and process, but may also shape strategy (i.e. as opposed to only being driven by other organizational elements).

Notably, a key limitation from Table 3-4 is that none of the frameworks presents empirical evidence and are thus only conceptual in nature and seldom specify constructs for each of their organizational elements. Thus, although theoretical contributions have been made suggesting how different organizational elements are interrelated and that their congruence assumingly enables organizational performance, the question still demands empirical study and additional theoretical refinement. Specifically, in the context of this research this thesis poses the following research question: ***Can one create an enriched understanding of hospital enterprise architecture?***; our follow-on and final research question for this thesis then becomes: ***Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?***

Ultimately, it is helpful to distinguish future contributions in terms of suggested enterprise architecting interaction recommendations (i.e. which organizational elements drive/are driven by other elements), or instead, reflect an enterprise diagnostic mindset which holds no pre-conceived notion of organizational element interactions including strength and direction. The latter is most appropriate in the context of this research given the nascent phase of EA theoretical development and the intent to iteratively improve our understanding and characterization of each of the EA views both individually and holistically while comparing and contrasting empirical results and ultimately enriching

our understanding of EA, and that of hospitals in particular. As such, another value of Table 3-4 is that it shows a convergence in terms of organizational elements which allows to mitigate the absence of a universally agreed upon set of EA views, and demonstrates that MIT'S NREAF offers the most complete conceptualization and is thus the most appropriate to inform this research.

Finally, as per the suggestion of Drucker's theory of the business (1994)[45] one can begin uncovering and articulating the relationship between Lean Enterprise Principles (Chapter 2) and Enterprise Architecture, and what is entailed in rethinking an entire enterprise (Nightingale 2002).

Table 3-5: Summary of LAI's Lean Enterprise Principles (Nightingale 2009)

Lean Enterprise Principle	Description
1	Adopt a holistic approach to enterprise transformation
2	Identify relevant stakeholders and determine their value propositions
3	Focus on enterprise effectiveness before efficiency
4	Address internal and external enterprise interdependencies
5	Ensure stability and flow within and across the enterprise
6	Cultivate leadership to support and drive enterprise behaviors
7	Emphasize organizational learning

For instance, the following is a complementary analysis of Table 3-4's publications using the 7 Lean Enterprise Principles (summarized in Table 3-5):

- 1st Principle: at a glance it is clear that no single framework is as complete as the NREAF in terms of the individual organizational elements that are deemed important. Such is similar to the previous assessment made on the IT lenses of EA.
- 2nd Principle: although almost all of the frameworks include *organization* and *policy/external* they do so often times either from a customer (i.e. end-user) or employee perspective, and neglect to consider the wider ensemble of enterprise stakeholders (e.g. suppliers, regulators, unions, etc) which form a multiple constituency value proposition for the enterprise.
- 3rd Principle: those publications with no appreciation for strategy would be less

[45] Described in greater detail in Chapter 2 Section 2.4

likely to observe the tradeoffs between efficiency and effectiveness (e.g. empirical efforts would be made to understand how all departments share information in a given enterprise, when perhaps some departments aren't even included in the enterprise's strategic objectives). Similarly, those publications mainly adopting an IT lens fail to consider architecture solutions which don't necessarily include IT (e.g. explore whether a process can be redesigned or even eliminated before automating it with IT)

- 4th and 5th Principles: none of the contributions include descriptions akin to the systems thinking concept of *service/product* architectures. Although stability and flow are desired behaviors emerging from a given enterprise design, they are fundamentally linked to the essential design consideration of addressing internal and external interdependencies (e.g. empirical efforts could benefit from a structure and potential phenomena of interest stemming from following a patient throughout a value stream, rather than simply observing the interdependence amongst a random sample of departments). This is perhaps the primary limitation of previous frameworks as it represents a fundamental systems thinking principle without which characterizing and understanding system behavior is limited.
- 7th Principle: several of the frameworks don't include an explicit consideration for *knowledge* and/or *information* which are essential enablers of lean enterprises.

3.6 Chapter 3 Summary

In this chapter we used the organizational science and systems thinking literatures in the characterization of Enterprise Architecture. We introduced and gave several accounts of studies relating organizational design and organizational performance, including healthcare and other service domains. Recognizing that authors use different constructs of performance and focus on different aspects of organizational design, we categorized and discussed the advantages and limitations of three different types of conceptualizations, namely the universalistic perspective, the contingency perspective, and the configurational perspective.

Having identified the value of the configuration perspective as a means of holistically studying patterns of multiple interdependent organizational variables and relating them to performance, we used as many as ten of its most influential organizational frameworks to inform our research. To that effect we conducted a longitudinal review which discusses at length the convergence towards a set of common organizational elements, and the different theoretical considerations as to how they interrelate and ultimately affect performance.

Finally, we introduced Enterprise Architecture from a systems thinking perspective and first examined its predominant interpretation from an IT lens, followed by a broader Lean Enterprise lens. In examining in detail MIT'S NREAF we noted its nascent phase of development, but by comparing it in a synthesis of other frameworks, we selected it as the most complete representation to inform this research. Furthermore, we not only found support for its EA views, but also clarified its contribution beyond being holistic, exploring EA view interactions, and being non-IT centric. To that effect, we also articulated how the theory of the business, or rather the Lean Enterprise Principles, are intimately related with how one conceptualizes EA and explores its EA view interactions.

Ultimately, we established the need to enrich MIT'S NREAF, and doing so in the context set by this thesis (i.e. hospitals). Specifically, we posed our two remaining research questions for this thesis:

- ***Can one create an enriched understanding of hospital enterprise architecture?***
- ***Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?***

In the next chapter we frame the health care literature to offer a systems perspective and that of hospitals in particular. Furthermore, the chapter discusses key hospital characteristics and how these in turn need to be reflected in this thesis' research design, so as to adequately address our four research questions.

4. Understanding the US Health Care System and Hospitals in Particular

In the previous two chapters we presented the core of the knowledge-base used to inform the data collection and analysis of the hospital exploratory research cases presented in this dissertation. In Chapter 2 we reviewed the literature on enterprise performance measurement and also included a multidisciplinary analysis on hospital performance measurement in particular, having found that it traditionally has focused on one or two performance dimensions, and although most recent publications advocate broader performance assessments, these are still at a conceptual level and lack empirical data. In Chapter 3 we conducted a multidisciplinary longitudinal literature review on the theoretical evolution of enterprise architecture, and concluded that MIT's emerging Nightingale-Rhodes Enterprise Architecture Framework (NREAF) offers the most complete conceptualization of enterprise architecture and is thus the most appropriate to inform this research.

This chapter is the third and final chapter of our knowledge-base where we specifically examine the healthcare literature from a system's perspective. We begin by describing how the US health care system is generally considered fragmented and referred to as a *cottage industry*. Next, we examine the US health care system's performance both using specific internal studies on various performance dimensions, and also using international benchmarks conducted by reputable third party organizations. We then proceed with the examination of the US health care system's regulatory and payment environment. Finally, we investigate US hospitals in particular by first describing their key challenges, followed by an analysis of their inherent complexity and heterogeneous characteristics, and ultimately we identify the literature's recommendation for the preferred hospital model given the US health care system's overall context.

4.1 The US Health Care "Cottage Industry"

Today, one would be hard pressed not to find negative assessments of the US health care industry. Politicians characterize a system with serious problems such as costs rising at three times the inflation rate, an overwhelming number of uninsured Americans, sky rocketing malpractice insurance fees, and low government reimbursement rates (Grassley 2009). Others, refrain from using the terms "*system*" and "*health care*" in the same sentence given the dysfunctional fragmented payment layer comprised by public programs, private markets, employer-based insurance, and special initiatives (Redlener and Grant 2009). Similarly, the president of Johns Hopkins University was quoted: "*Simply stated, the US does not have a health care system*" (Eastman 2007) as he alluded to the highly fragmented nature and variation of billing, care provision, accountability, safety, etc, inherent in the delivery of care.

Truth be told, the negative publicity surrounding the US Health Care system isn't a product of today. For several decades there have been debates and a series of piecemeal reforms which have left the system fundamentally the same (Porter 2009). In fact, already in the 1970s, one of today's most prominent health care systems thinkers was observing the beginning of a worrisome trend:

> *"Public concern over the rapid increase in hospital costs and the quality of services delivered has been a factor in the increase in regulation of the hospital industry."*
>
> (Shortell, Becker et al. 1976)

A characterization of the US health care system that has taken hold is that of it being a *cottage industry*, largely because of the proliferation of autonomous physicians practicing in small groups with limited oversight or coordination, who eschew standardization and deliver costly lower quality care (Swensen, Meyer et al. 2010). Ultimately, many agree the health care system presents a complex problem for which the solution is neither obvious nor likely to be painless (Chernew, Sabik et al. 2010). Specifically, "*all savings represent lost income for somebody, and affected stakeholders have successfully blocked, weakened, or circumvented past attempts at cost control*" (Hussey, Eibner et al. 2009).

For these reasons, our research stands to benefit from a systems perspective that examines the US health care's complex socio-technical characteristics from multiple enterprise perspectives.

4.2 US Health Care System Performance

The key categories often referred to when assessing the performance of the health care system are access, quality, and cost. In terms of access, an estimated 15% of the US population is uninsured (Thorpe 2007), as much as 75% of care providers practice alone or in groups of five or fewer (Blumenthal and Glaser 2007). Furthermore, as many as 50% of the US bankruptcy filers in 2001 stated that their medical related expenses led to their financial downfall, and as many as 75% of them had insurance at the onset of illness (Himmelstein, Warren et al. 2005). As for quality, adults on average are said to only receive as little as 55% of the recommended care for many common conditions (McGlynn, Asch et al. 2003), and between 44,000 to 98,000 annual deaths are attributed to medical errors (Kohn, Corrigan et al. 2000). A medical error can consist of a planned action not being carried out or the wrong plan being executed altogether for a given need. Specific errors may include adverse drug events, surgical injuries, wrong side injury, falls, mistaken patient identities, etc. To put things into perspective, one should consider that even by the lowest estimate, medical errors are the 7th leading cause of death in the US, which is worse than motor vehicle accidents (43,458), breast cancer (42,297), or AIDS (16,516) (Chalice 2005).

The Commonwealth Fund Commission on a High Performance Health System evaluates the US Health Care system at 66%, where 100% refers to the top known performers (Berwick, Nolan et al. 2008). Said study found that although US health expenditures are considerably higher than those of other developed nations, the health outcomes aren't any better. A recent study from the World Health Organization (2010) reported that the US ranked 36th in terms of life expectancy at birth, 40th in terms of neonatal mortality rate, 42nd in terms of infant mortality rate, and 33rd in terms of healthy life expectancy, despite being the 4th country to spend the most per capita on health related expenses (see Table 4-1).

Table 4-1: World Health Organization Health Economic data per country(adapted from WHO 2010)

Country	Health				Economic		
	Life expectancy at birth (years) (rank in 2008)	Neonatal mortality rate (per 1000 live births) (rank in 2008)	Infant mortality rate (probability of dying by age 1 per 1000 live births)(rank 2008)	Healthy life expectancy (HALE) at birth (years) (rank 2008)	Per capita total expenditure on health at average exchange rate (US$) (rank 2007)	Total expenditure on health as % of gross domestic product (2007 data)	General government expenditure on health as % of total expenditure on health (2007 data)
Japan	1	2	15	1	23	8	81.3
San Marino	2	1	1	2	17	7.1	85.5
Andorra	3	6	13	6	21	7.6	69.8
Australia	4	23	26	9	16	8.9	67.5
Iceland	5	3	6	5	6	9.3	82.5
Italy	6	7	16	7	20	8.7	76.5
Monaco	7	8	11	13	3	4	74.8
Switzerland	8	24	28	3	5	10.8	59.3
Canada	9	38	36	20	12	10.1	70
France	10	9	10	12	8	11	79
Israel	11	10	25	18	28	8	55.9
New Zealand	12	39	35	19	22	9	78.9
Norway	13	11	14	14	2	8.9	84.1
Singapore	14	4	4	11	36	3.1	32.6
Spain	15	12	23	8	24	8.5	71.8
Sweden	16	13	5	4	11	9.1	81.7
Austria	17	25	21	25	10	10.1	76.4
Belgium	18	14	19	24	15	9.4	74.1
Cyprus	19	15	27	32	30	6.6	45.6
Finland	20	16	8	21	19	8.2	74.6
Germany	21	26	20	15	14	10.4	76.9
Greece	22	17	12	22	25	9.6	60.3
Ireland	23	27	22	16	9	7.6	80.7
Luxembourg	24	5	3	10	1	7.1	90.9
Malta	25	18	46	27	33	7.5	77.5
Netherlands	26	28	24	17	13	8.9	82
Republic of Korea	27	19	34	30	34	6.3	54.9
United Kingdom	**28**	**29**	**33**	**26**	**18**	**8.4**	**81.7**
Denmark	29	30	18	23	7	9.8	84.5
Portugal	30	20	9	29	27	10	70.6
Slovenia	31	21	2	28	29	7.8	71.5
Chile	32	45	43	34	55	6.2	58.7
Costa Rica	33	56	59	37	66	8.1	72.9
Kuwait	34	51	53	36	43	2.2	77.5
United Arab Emirates	35	46	44	39	35	2.7	70.5
United States of America	**36**	**40**	**42**	**33**	**4**	**15.7**	**45.5**
Cuba	37	31	31	35	57	10.4	95.5

A useful exercise is to cross-reference the data of the World Health Organization with that of the Organization for Economic Co-operation and Development (OECD 2009) and determine how countries compare in terms of the number of their practicing generalist and specialist physicians, as well as the number of medical graduates (see Table 4-2)[46]. Notably, the US is amongst the countries with the lowest ratio of practicing physicians as well as the lowest ratio of medical graduates, per capita. Furthermore, the US is below average in terms of the ratio of generalist and specialist physicians per capita, as well as the gap between generalist and specialist physicians.

Table 4-2: OECD Physicians (practicing/graduates/general/specialist) (adapted from OECD 2007)

Country	Practising physicians per 1 000 population, 2007	Medical graduates per 100 000 population	General practitioners per 1 000 population, 2007 (or latest year available)	Specialists per 1 000 population, 2007 (or latest year available)
Japan	2.09	6	#N/A	#N/A
Australia	2.81	10.1	1.43	1.35
Iceland	3.72	11.6	0.64	2.28
Italy	3.65	11.6	0.92	..
Switzerland	3.85	8.1	0.53	2.78
Canada	2.18	6.2	1.04	1.13
France	3.37	5.5	1.64	1.73
New Zealand	2.31	6.7	0.76	0.79
Norway	3.86	10.6	0.82	2.16
Spain	3.65	8.7	0.86	2
Sweden	3.58	10	0.6	2.56
Austria	3.75	19.4	1.53	2.22
Belgium	4.03	6.9	2.01	2.02
Finland	2.95	6.9	0.73	1.56
Germany	3.5	11.6	1.48	2.03
Greece	5.35	13.3	0.31	3.39
Ireland	3.03	16.5	0.53	1.06
Luxembourg	2.87	#N/A	0.82	2.04
Netherlands	3.93	12.3	0.47	1.01
United Kingdom	2.48	10.2	0.72	1.77
Denmark	3.17	21.7	0.77	1.16
Portugal	3.51	7.7	1.82	1.69
United States of America	**2.43**	**6.3**	**0.96**	**1.46**

[46] The available OECD dataset presented in Table 4-2 is ranked using the same rank featured in Table 4-1. Specifically, Japan being ranked 1st by the WHO, is placed 1st in OECD's table, and so on.

Further inspection of Table 4-1 reveals that in 2007 the US spent 15.7% of its GDP on health care expenditure. Specifically, 30-40% of said expenditures are thought to be wasteful (Reid 2005) and for that reason the US health care system is said to be "*larded with inefficiency*"(Chernew, Sabik et al. 2010). For instance, in 1999, as much as 31% of health care expenditures in the US were attributed to administrative costs (Woolhandler, Campbell et al. 2003). Also, with the government's spending nearing 50% of all health care expenditure, some argue that the most important force shaping the US health care system may be federal debt (Chernew, Baicker et al. 2010). Ultimately, US health care reform discussions have centered on insurance with standard benefit packages (Cortese and Smoldt 2007) or deep-in-the-weeds debates over technical details (Murray 2010), and little attention has been given to the care delivery itself thereby undermining the ability to improve the quality of care and slow the growth of spending (Rittenhouse, Shortell et al. 2009). However, the US is not alone in this approach and both the UK and Canada, among others, have been found to mostly pursue administrative fiscal interventions with little effect on the actual delivery of care (Glouberman and Mintzberg 2001).

A closer examination of the US's healthcare spending is provided by the Centers for Medicare and Medicaid (2009) in Figure 4-1.

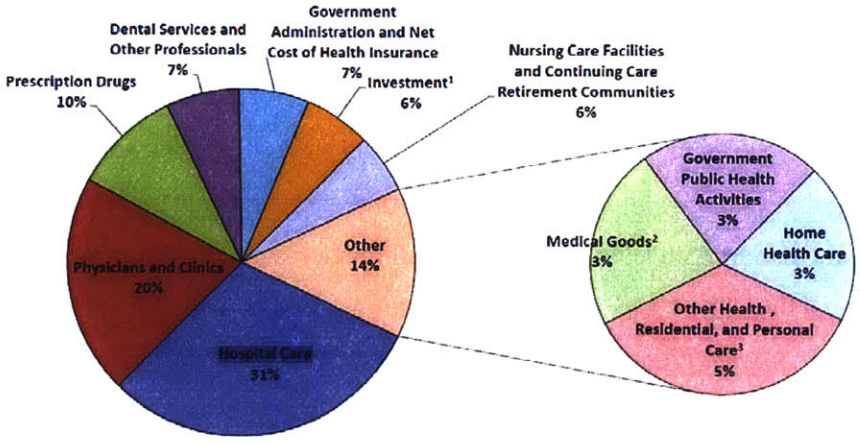


Figure 4-1: US Health Dollar, Where it Went in 2009

The largest source of expenditure, namely over 30%, is hospital expenditures. Similarly the United Kingdom's (UK) highest source of healthcare expenditures are hospital services and infrastructure (National Health System 2008). Consequently, the strategies and operations developed and implemented by hospitals have a significant effect on access, quality, and cost of care (Devers, Brewster et al. 2003) and are considered the top priority for improvement (Chalice 2005).

With regards to spending patterns there are different ways of examining US health care's expenditure. To begin with, 10% of the patients account for 70% of the total health care expenditures. Said patients traditionally have multiple chronic conditions, are admitted frequently to hospitals, take many medications, and have difficult in independently performing their daily functions (Bodenheimer and Berry-Millett 2009). In terms of Medicare, whose patient population is comprised of beneficiaries 65 years and older, a total of 98% was spent on patients with one or more chronic conditions. Additionally, in general, on "average per capita spending on people with one or more chronic conditions is more than five times greater than spending on people without any chronic conditions" (Anderson 2007).

Finally, when considering the US health care system's performance it is important to mention that some states, at least in terms of Medicare, spend considerably more than others and don't deliver higher-quality care or generate greater patient satisfaction (Fisher, Wennberg et al. 2003; Sutherland, Fisher et al. 2009). Figure 4-2 led some authors go as far as saying that "*states with higher Medicare spending have lower-quality care*" (Baicker and Chandra 2004). In terms of overall quality without regards to spending, one of the key benchmarks of America's health rankings concluded that in 2010 the top 3 states in the US were Vermont, Massachusetts, and New Hampshire, which have steadily remained in the top 10 for the past 10 years (AHR 2010).

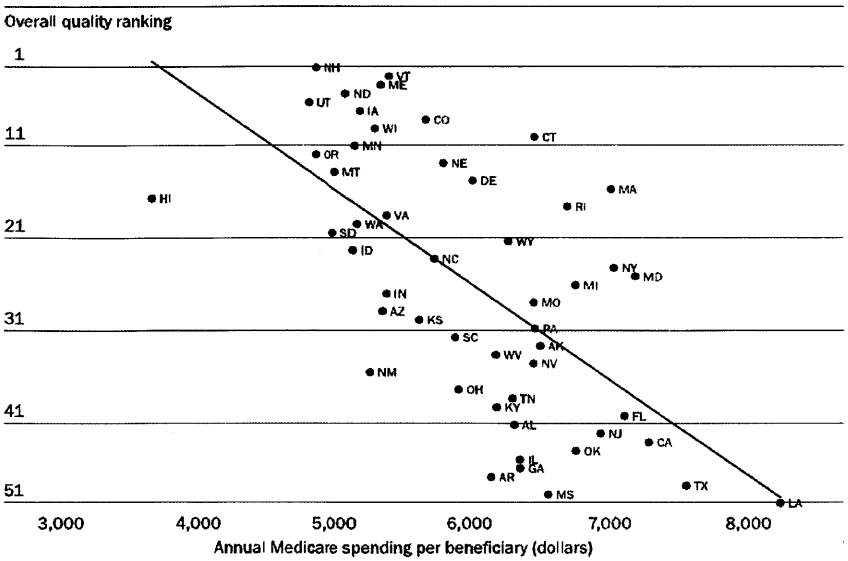


Figure 4-2: Relationship between quality and Medicare spending as expressed by overall quality ranking 2000-2001

Ultimately, the US health care system is faced with serious challenges in terms of expenditures and the resulting poor performance. However said performance varies considerably from state to state. Overall a significant amount of health care spending is thought to be wasteful, and hospitals representing the largest source of expenditure are necessarily considered the priority for research and improvement. With that in mind, the remaining sections examine the health care system while using hospitals as the focal unit of analysis.

4.3 US Health Care System Regulation

The effect of regulation on the US Health Care system, as expected of any complex socio-technical system, is such that changing even the smallest of features of legislation can have major, and sometimes unintended, impacts in the system's evolution (Butler 2010). An example commonly referred to in this regard is President Lyndon Johnson's concession to the American Medical Association in 1965 that physicians charge Medicare the "usual and customary charge" and hence they had no concern towards

saving costs where possible (Starr 1982; Stevens 1989; Tolnay, Berkowitz et al. 1993). As such, it is important to describe an overview of the system's regulatory environment.

Some of the key organizations involved in the regulation of the US Health Care system include the National Committee for Quality Assurance (NCQA), the Joint Commission for the Accreditation of Health Care Organizations (JCAHO), the National Forum for Health Care Quality Measurement and Reporting (NQF), and the Centers for Medicare and Medicaid Services (CMS). When considering Figure 4-3, the regulatory environment for hospitals in particular is generally regarded as cumbersome and confusing (AHA 2005).

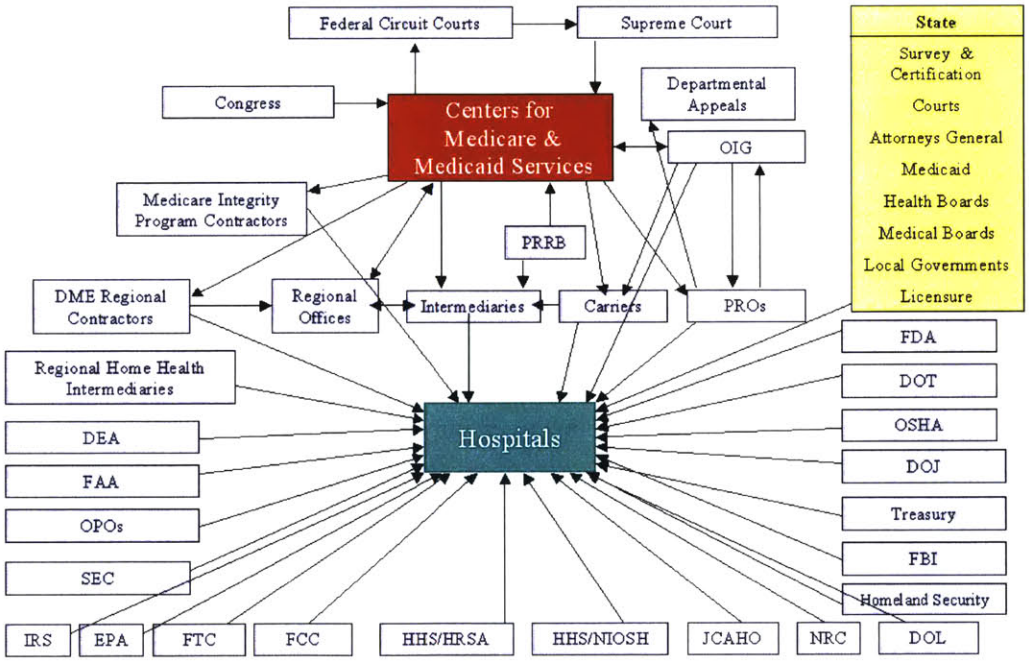


Figure 4-3: US Hospital's Regulatory Overview (AHA 2005)

Specifically, different types of regulators focus their attention on different types of issues, and in turn, pressure hospitals to improve from their isolated perspective. For instance, whereas NCQA and JCAHO have historically focused on process based measures (e.g. evidenced-based-medicine guidelines such as taking an aspirin within 15 minutes of a patient presenting chest pain in the ED), other organizations such as the Leapfrog Group, and state based agencies, have focused their attention on outcome (e.g. patient

satisfaction) and structural measures (e.g. patient to nurse ratios) (Romano and Mutter 2004). The end result for hospitals is that "*the number and variety of different quality-reporting systems is a source of increasing confusion and irritation*" (Blumenthal and Epstein 1996).

The following is a description of key legal Acts often referred to in the health care literature as having a significant effect on health care providers in particular:

- **Antitrust Sherman Act (1890):** the act regulates interstate commerce and declares illegal every contract or other vehicles which restraints interstate and foreign trade. In a hospital context, the concern is to have oversight of potentially damaging health care provider market power, which could translate into price-fixing or raising prices above competitive levels (AHA 2010).
- **Tax Equity and Fiscal Responsibility Act (1982):** in response to the problematic rise of health care expenditure's, the TEFRA act mandated the development of a prospective payment system for Medicare hospital reimbursements. As such, hospitals could no longer charge on the basis of "usual and customary charges" (otherwise known as retrospective model[47]), and instead were paid a fixed amount calculated on the basis of nationwide provider averages. Said payments had no bearing on a hospital's actual costs in providing its services, and weren't open to negotiation.
- **Emergency Medical Treatment and Labor Act (1986):** the act requires hospitals and ambulance services to provide care to anyone needing emergency care regardless of their ability to pay (Murray 2010).
- **Stark Law (1989):** the act prohibits physicians from making referrals for certain designated health services payable by Medicare to a provider with whom said physicians (or immediate family members) have a financial relationship (compensation, investment, or ownership). The rationale is to prevent physicians' potential self-serving behavior of ordering unnecessary tests or selecting providers based on a personal financial reward for doing so (Centers_Medicare_Medicaid_Services 2010).

[47] For a detailed explanation of the different payment model types please refer to section 4.4.

- **Health Insurance Portability and Accountability Act (1996):** HIPAA created a framework for defining patient privacy, breeches of privacy, and penalties. The act had a direct impact on electronic medical records in particular (Shea and Hripcsak 2010).
- **Medicare Improvements for Patients and Providers Act (2008):** the act requires the secretary of health and human services to evaluate methods for ongoing data collection and the measurement and evaluation of disparities in terms of patient race, ethnic background, and gender (Siegel and Nolan 2009).

Ultimately, hospitals are not only embedded in a fragmented care delivery *cottage industry*, but also presented with a regulatory environment which further contributes to the industry's fragmentation, and poses additional challenges in reconciling the demands of the multiple stakeholders.

4.4 US Health Care System Payment Structure and Influence

In 2006 the Institute of Medicine (IOM) produced a study on the US health care payment system and found that "*the current Medicare payment system is broken. It provides few disincentives for overuse, under use or misuse of care and does not reward efficiency*" (IOM 2006). Moreover, the IOM committee concluded that current payment systems don't recognize or reward the coordination of care, and both preventive care and the treatment of chronic patients who move across various care settings are omitted. In essence, the current payment system has been considered one of the primary reasons for the US health care system's fragmentation, unreliability, and waste (Fisher 2006). Next we examine several aspects contributing to this assessment, and demonstrate how these aren't once again a product of today, but rather a continuous systemic issue from before.

To begin with, once again we find that negative assessments about the US health care system, and its payment system in particular, aren't a product of today. Already in the late eighties there were calls for the integration of health care's financial system, and that

it recognize that "*clients are whole human beings, and providing them with integrated services necessitates some integration of payment sources*" (Vladeck 1987).

4.4.1 Overview of key US health care payment models

The following is an overview of the key payment models that exist either in isolation or in some combination for any hospital in the US:

- **Retrospective payment model:** as noted, prior to 1983, Medicare made payments based on "usual and customary charges" otherwise known as the retrospective payment system (RPS). Essentially, hospitals would charge Medicare their baseline costs plus some percentage to cover their services. In some specific circumstances, the RPS is still in place today (e.g. critical access hospitals located in remote areas).
- **Medicare prospective payment model:** Medicare introduce the prospective payment system (PPS) in 1983 which became the inpatient hospital services standard for over 90% of US providers (Younis and Forgione 2009). With the shift to PPS hospitals were paid a fixed predetermined amount based on a patient's principal diagnosis and treatment code which would fall under a specific diagnose related group (DRG). Said amount is based on the average price of all hospitals in the US, and isn't subject to negotiation. Therefore, for each inpatient stay, hospitals are only reimbursed on the basis of a single DRG, regardless of the costs incurred whilst providing their services. As a result, in some cases hospitals make a profit or a loss per DRG. Furthermore, if an outpatient visit results in an inpatient admission within 72 hours, the hospital is only reimbursed on the basis of the single DRG (e.g. the services provided in an emergency department aren't billed separately, and are instead considered part of the overall cost of services rendered).
- **Fee-for-service payment model:** with the generalized pressure to control costs while maintaining reasonable levels of quality, managed care systems such as health maintenance organizations (HMOs) began to emerge (Douglas and Ryman 2003). Much like Medicare attempted to curb costs incurred by the government, HMOs did the same for the patient enrollees sponsored by employers who

contracted (or indeed emulated) their services (Dranove and White 1994). Furthermore, large employer purchasers in particular required that health plans include specific performance metrics and collect and report data on them (Eddy 1998). Fee-for-service (FFS) represents one of the contractual vehicles between providers and private insurers, and can also be used with Medicare in special circumstances (i.e. negotiated carve-outs for specific services). FFS is different from RPS in that the prices charged by providers are negotiated ahead of time with payers. Conceivably, the same provider will negotiate with different payers, different prices, for the same service. Conversely, the same payer will negotiate with different providers, different prices, for the same service. Hence, service pricing is arguably more a function of bargaining power rather than the quality and efficiency of services provided (Porter 2009).

- **Capitation payment model:** the incentive structure of the traditional FFS reimbursement evolved towards the incorporation of risk-sharing, otherwise known as the capitation payment model. The capitation payment model introduces control mechanism to curb health care services utilization, and whereby a provider is paid a fixed amount per month and per patient included in its risk pool. As such, regardless of what a hospital spends in caring for its patient pool, it receives the same amount whether or not patients underwent care (Zinn and Mor 1998).
- **Pay for performance model:** pay for performance (P4P)[48] is the most recent health care payment model whereby payers (private and public) pay providers for achieving predetermined goals considered to be a priority by each payer. As previously noted, some organizations focus on evidence-based-medicine processes, while others focus their attention on medical outcomes or structural measures.

[48] Although it may seem inconsistent to abbreviate fee-for-service as FFS and pay-for-performance as P4P, such reflects the practices denoted in the literature and mainstream media.

4.4.2 Overview of specific effects from each payment model

Each of the previously described payment models has induced both similar and distinct behaviors amongst providers, as evidenced in the following overview:

- **Medicare effects:** Bazzoli et al (2008) provide a useful review of the effects of Medicare changes, on the behaviors of providers as measured by their services rendered. The literature's consistent finding is that the introduction of DRG's lowered both service intensity and hospital lengths of stay (i.e. how long a patient remained as inpatient in a hospital). One study found that hospital occupancy rates dropped 12% nationally and that they suffered a dramatic downward shift in the their operating profit margins (Guterman and Dobson 1986). Some evidence was also found in terms of specific adverse impacts on patient health outcomes (e.g. acute myocardial infarction patients had worse outcomes than before the introduction of DRGs). Finally, others have noted that Medicare's DRG introduced weighting factors to adjust payments to the specific markets characteristics of a given provider (e.g. wage prices, patient case-mix, provider geographic location, etc). However, said adjustments were said to account for only a modes percentage of the variation in costs, thereby forcing underpaid providers to either exit the market or being to avoid high-cost patients (Robinson 2001).
- **Specific HMO effects:** the rationale behind managed care (e.g. HMOs) was to increase buyer power relative to healthcare service providers like hospitals. As with other industries, the effect of HMO buyer power varied within and across states as these had significant differences in the total number of patients enrolled in their programs, versus the total number of patients covered by Medicare. In general, HMOs stimulated intense competition with and between hospitals (Douglas and Ryman 2003). Furthermore, the nature of the risk sharing contracts was also shown to lead physician's to reduce their service offering (Zinn and Mor 1998). For instance, one study found that increases in HMO market share led to a lower number of cardiac catheterizations, angioplasties, and coronary artery bypass graft procedures (Volpp and Buckley 2004). However, HMO participation was also associated with greater adherence to evidence-based-medicine (Brook,

Kamberg et al. 1990).

- **Fee for service effects:** FFS allows for physicians to exercise a higher degree of freedom which in itself has been one of the US health care system's defining characteristics (Fisher 2006). Furthermore, despite efforts to improve payment risk adjustments between payers and providers, it remains that health risks have yet to be sufficiently defined so as to allow hospitals to bear the full risks of caring for high-risk patients in a non FFS environment (Wang, Conroy et al. 2009). Such an assertion is understandable if we remind ourselves of the expenditure weight that patients with multiple chronic illnesses today represent (e.g. 98% of Medicare's expenditures were spent on beneficiaries with one or multiple chronic diseases; 10% of the patients account for 70% of the total health care expenditures). Additionally, FFS also supports the introduction of the latest innovations which ultimately drive technological evolution and set new clinical excellence practices (Kerr and Scott 2009). However, FFS also has the perverse financial incentive for physicians to maximize the elective services they provide, or to introduce unnecessary expensive technologies (Relman 2009). Also, FFS is also said to pressure physicians into dedicating less time with their patients and to refer them to the emergency department, who in turn recognizes that it doesn't have enough time to treat the patient and admits them to the hospital (Gawande, Fisher et al. 2009). Moreover, there is a cascading effect amongst physicians referring patients that they could themselves treat if they had the incentive to spend more time with them. Ultimately, FFS is associated with a health care system that pays for volume rather than value (Swensen, Meyer et al. 2010).
- **Capitation effects:** whereas FFS incentivizes volume (i.e. more surgeries, more admissions, more tests), capitation incentivizes hospitals to keep their patients healthy and to treat them in the most cost effective manner (Shortell, Gillies et al. 1994). Furthermore, capitation was found to promote the integration between physicians and hospitals with regards to administrative and practice related management services, as well as financial risk sharing, the creation of new services, the investment in computerized integration, and hospital physician

integration overall (Bazzoli, Dynan et al. 2000)[49]. On the downside, capitation also creates incentives for hospitals to use less services which could potentially be harmful for patients (Shortell, Gillies et al. 1994).

- **Pay for performance effects:** Pay for performance is recognized as a potential driving force to improve quality of care, but it also induces fear amongst physicians in that P4P will focus on the efficiency aspect of care (i.e. the cost of care) and neglect the overall quality of care (Fisher 2006). Specifically, P4P has the potential consequence of misaligning the goals of patients and physicians, as physicians "will be financially motivated to pressure patients into accepting a mandated treatment, regardless of whether it is compatible with their values or preferences, or to avoid caring for patients who refuse the mandated treatment". (Hartzband and Groopman 2009). A recent study received approximately 1000 physician survey responses where 54% of them reported having a fundamental moral objection to using cost-effectiveness data "to determine which treatments will be offered to patients" (Antiel, Curlin et al. 2009).

Given the pros and cons presented above, some authors have argued that hospitals should operate under multiple payment models, as opposed to a single control system, so as to find the right combination according to the specific economic incentives confronting a particular stakeholder (Flood 1994). However, while acknowledging the theoretical sense of such mixed models, more recent publications have noted that most compensation systems are relatively simple (Robinson 2001). Essentially, the greater the number of models in operation for a single hospital, the greater are its administrative costs in negotiating, implementing, and disputing payments with the various payers. Furthermore, the complexity of mixed models only increases with the existence of multiple independent payers for a single hospital, who is ultimately undermined in any efforts to be compliant while facing different incentives from multiple payers (Robinson 2001).

[49] It is important to keep in mind that hospitals in general may have different arrangements with the physicians that practice in their premises. A simplified description is that hospitals may either contract physicians to work for them, or they may be contracted by physicians in order for them to practice. As such, the outlined capitation benefits were specifically in the context of contractual relationships between independent physicians and hospitals.

In between the lines however, lies a larger discussion to do with the possibility of a single payer system which has fueled many public and political debates without a clear conclusion as of yet. If anything, it represents yet another uncertainty factor for hospitals that will have to once again adjust their service offering to how the payment system evolves around them.

4.4.3 Overview of the general effects of the US Health Care System Payment Structure

The following are additional key behaviors induced by the health care system's payment structure:

- **Payers set the direction:** the payment system is not only considered fragmented but also responsible for contributing to "*very significant changes in patterns of health care when payments change*"(Gawande, Fisher et al. 2009).
- **Managed care induced conflict between hospitals and physicians:** while using data from the late eighties, the existence of managed care organizations, which came to be with the intent of coordinating care and reducing provider costs, was associated with increased conflicts between hospitals and individual or group practice physicians (Burns, Andersen et al. 1993).
- **Payer metrics are costly to collect**: in general, the public-reporting requirements set by both regulators and payer organizations aren't not only prohibitive for the fragmented *cottage industry* providers, but also for the hospitals and large medical groups themselves (Fisher 2006). More often than not, providers have to collect data by hand and review paper-based medical records, or make significant investments in electronic medical records (Fisher 2006).
- **Payer metrics may scare cautious physicians:** concerning the metrics themselves, physicians are said to be largely unfamiliar of how evidence-based information can guide them towards cost-effectiveness practices, and are hence fearful of change and potentially resistant to any change in that direction (Antiel, Curlin et al. 2009).
- **Payer metrics reinforce narrow thinking:** insurance companies drive physicians "*deeper into their own pigeonholes, on which the measurements are*

based, which further discourages the needed coordination" (Glouberman and Mintzberg 2001). Similarly, hospitals are rewarded for volume and while interested in higher local efficiency, they are fearful of systemic efficiencies which would reduce their revenues or admission rates, and hence threaten their profitability (Berwick, Nolan et al. 2008).

All in all, the US health care system payment structure doesn't incentivize patient-centric behavior, and instead rewards providers who cost shift, bargain better margins, and bill for more services, rather than reward those who deliver the most value (Porter 2009). More simply, some have argued that "*as long as doctors are paid more for ordering and doing than for listening and talking, the zest for procedures will regularly exceed the quest for caring*" (Feinstein 2002).

Finally, it is important to note the payment structure's influence on patients themselves, as their cost sharing has been shown to affect their use of health services (Rosko and Broyles 1988). Notably, the lowering of patient copayments on specific categories, which induce higher usage of said categories, isn't necessarily inefficient system use when considering the patient disease management as a whole (Hussey, Eibner et al. 2009). Specifically, in the case of patients with chronic diseases, their adherence to drug regiments may lower their use of hospital services. Also, amid calls for consumer driven health care (Porter 2009) it is important to note that studies have shown that patients do not always make the right decisions about the use of services when they are faced with high cost sharing, and their behavior may hence lead to suboptimal clinical outcomes (Chernew, Sabik et al. 2010). Ultimately, payment systems affect both health care service providers, and those who use those services, and hence, further evidence of potential fragmentation.

4.4.4 Additional sources of physician financial incentives

When considering the health care system's financial incentives for providers, it is important to also consider that said incentives exist beyond the payer organizations that procure services for patients. One example is that of health care suppliers such as

equipment manufacturers and pharmaceutical companies who contract hospitals for their clinical trials, or even physicians themselves. So much so that physician earnings stemming from pharmaceutical sources are tracked by the local media of where said physicians practice. For instance, The Boston Globe published a report of the top five physician earners in payments from pharmaceutical companies, and specify where they graduated from, what their specialty is, and where they practice (Boston_Globe 2010). Notably, two of the physicians resigned from pharmaceutical company speaking bureaus shortly after the report was published.

4.5 US Hospitals

The previous sections have shared a common theme, namely that of fragmentation. The US health care system's delivery infrastructure is characterized as a *cottage industry*. Similarly, health care's regulatory environment has a proliferation of stakeholders who focus on different values and demand different things from hospitals and providers in general. Furthermore, health care's payment system presents not only a series of administratively heavy models with potentially conflicting effects, but also induces narrow thinking amongst hospitals. As noted previously, hospitals represent the largest source of health care expenditure and are considered the top priority for improvement. Having characterized hospital's external environments, in this section we turn towards further understanding US hospitals.

4.5.1 US Hospitals core challenges

The American Hospital Association (AHA 2008) provides a fact sheet on hospitals which includes the following information:

- Over 35 million people are admitted to the hospital each year.
- Hospitals treat nearly 118 million people in their emergency departments (EDs) and provide care to 481 million other outpatients each year.
- Hospitals employ more than 5 million people. Behind restaurants, hospitals are the second largest private sector employer. When also accounting for hospital

purchases of goods and services from other businesses, hospitals support one of every 10 jobs in the U.S and $1.9 trillion dollars of economic activity.

- Together Medicare and Medicaid represent 55% of care provided by hospitals. Medicare pays only 91 cents for each dollar spent caring for Medicare patients. Hospitals receive an average of 86 cents for each dollar spent caring for Medicaid patients. When Medicare and Medicaid fail to cover their share of hospital costs, hospitals are forced to make cutbacks that affect the whole community and/or look to the privately insured to make up the difference.
- In 2006, hospitals provided care to people in need at a cost of over $31 billion of care for which no payment was received (approximately 5.5% of total costs)

Almost a decade ago the key foundational issues threatening US hospitals were defined as follows (AHA 2002):

- Worker shortages that will reach crisis proportions in the coming decades without action now
- Rising demand and constrained capacity that cause emergency department overcrowding and ambulance diversion
- Regulatory burden that takes caregivers away from the bedside and diverts financial resources away from patient care
- Rapidly rising costs that, if not matched with increases in payment, threaten the financial stability of hospitals
- Growing number of uninsured people which threatens access to timely and appropriate care for more than 40 million Americans and strains the financial resources of the hospitals who care for these individuals
- Decreased access to capital—capital that's required to meet rising demand, keep up with advances in technology, and maintain facilities
- Payment shortfalls for Medicare and Medicaid.

A 2010 survey of hospital CEOs, with 525 respondents, asked respondents to rank 13 issues affecting their hospitals in order of importance (see Table 4-3). For five consecutive years financial challenges have ranked first on the list of this annual survey

sponsored by the American College of Healthcare Executives. Notably, the uncertainty of the health care reform legislation was introduced as a new top concern. Interestingly, capacity and technology were ranked 9th and 10th respectively. Similarly, patient satisfaction only scored 15% as a top concern amongst respondents. However, patient safety and quality scored 32%, while physician-hospital relations still score as high as 25%.

Table 4-3: Hospital CEOs top issues in 2009 (ACHE 2010)

Rank	Issue	2009	2008	2007
1	Financial challenges	76%	77%	70%
2	Healthcare reform implications	53%	NA	NA
3	Care for the uninsured	37%	41%	38%
4	Patient safety and quality	32%	43%	NA
5	Governmental mandates	30%	26%	22%
6	Physician-hospital relations	25%	32%	35%
7	Patient satisfaction	15%	22%	17%
8	Personnel shortages	13%	30%	30%
9	Capacity	7%	16%	11%
10	Technology	7%	9%	8%
11	Governance	2%	NA	NA
12	Disaster preparedness	1%	1%	1%
13	Issues about non-profit status	1%	2%	4%

A closer examination of the reasons behind the financial challenges include Medicare and Medicaid's reimbursement rates, the increasing costs for staff and supplies, and the emergency department. A 2004 survey found that as many as 48% of all US hospitals have their emergency department (ED) operating either at capacity or over capacity. Teaching hospitals were the ones struggling most with their ED, with as many as 77% of them reporting to be at capacity or over capacity (AHA 2005). ED overcrowding can be defined as "*a situation in which the demand for emergency services exceeds the ability of a department to provide quality of care within acceptable time frames*" (Rowe, Channan et al. 2006).

The concern towards ED overcrowding is related to patient safety and quality, given that the longer a patient remains in the ED the more the quality of care is compromised and

contributes to the delay in the evaluation of other patients (Herring, Wilper et al. 2009). Furthermore, a longer ED length-of-stay (LOS) has been found to contribute to increased LOS for the hospital as a whole, to a greater number of patient complications (i.e. morbidity), and an increased mortality rate amongst critically ill patients (Cowan and Trzeciak 2005; Chalfin, Trzeciak et al. 2007). A recent study by Press Ganey Associates, a healthcare quality improvement company, determined that the average ED LOS in the US was 4 hours (Press_Ganey 2010)[50].

A 2004 benchmark on the cost components for all hospitals found that salaries and wages represent over 50% of the cost structure, and that supplies are approximately 18% (see Figure 4-4). The same benchmark recognizes that a description of the 'average hospital' is inherently difficult given the existence of different patient case-mix indexes (i.e. patient acuity), different service offerings (e.g. cardiology, neurosurgery, obstetrics, etc) and case volumes (i.e. the more cases a hospital does the higher the variable cost categories and potentially the fixed costs also).

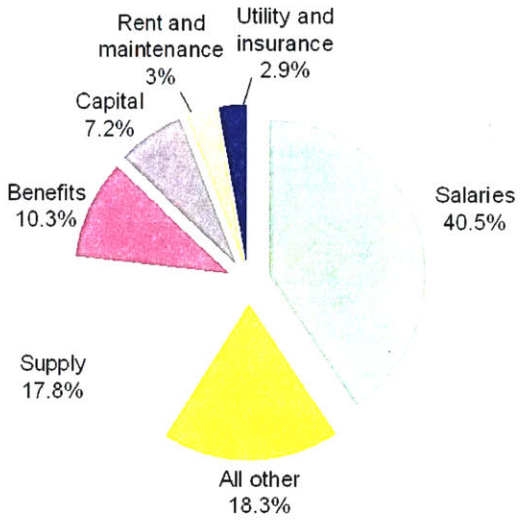


Figure 4-4: Operational Trends for the 'Average Hospital' (Solucient 2004)

[50] The same study mentioned that the LOS varied considerably by US. Additionally, having contacted a Press Ganey Associates representative they further clarified that the data is based on patient satisfaction surveys and does not include patient boarding time (i.e. admitted patients who remain in the ED awaiting to be transferred to an inpatient location).

4.5.2 Understanding hospital complexity and heterogeneous characteristics

Over the course of the previous sections we have highlighted different sources of heterogeneity when characterizing health care, and hospitals in particular. To begin with, the amount of health care spending and the resulting performance varies from state to state. Then, the payer landscape varies from state to state, and so do the bargaining power relationships between providers and payers within each state, thereby generating a wide range of prices for the same medical services provided by both different and the same hospital. Finally, different hospitals have different patient case-mixes, service offerings, and service volumes. Moreover, hospitals have a significant degree of heterogeneity both in terms of their environment as well as their internal characteristics. In research contexts' such as these, authors have noted the importance of typologies in supporting theory development (Doty and Glick 1994). With that in mind, in this section we proceed with the examination of typological hospital characteristics, and a more detailed characterization of the research limitations inherent in them.

To begin with, we discuss a framework for strategic service management (Kellogg and Nie 1995) which analyzes the relationship between service processes and service offerings, and uses specific hospital examples (see Figure 4-5).

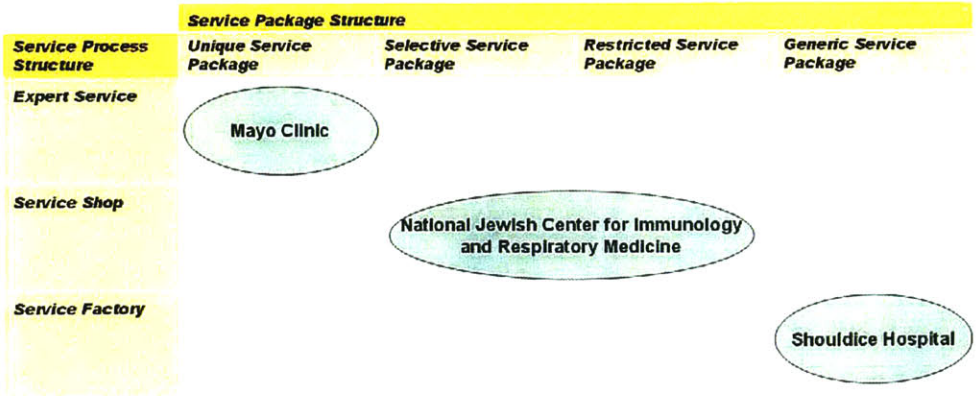


Figure 4-5: Hospital service process/service package matrix (adapted from (Kellogg and Nie 1995))

The service process structure describes the degree of customer influence. An expert service manages a high level of customer influence (e.g. consulting), whereas a service

shop has a medium level (e.g. education), and a service factory has a low level (e.g. fast food restaurants). In turn, the service package structure described the degree of service customization. In a unique package there is full customization and the customer has considerable discretion in defining the hows, whats, and wheres of the service. The selective package introduces some standardization, but a considerable part of the services still reflect the customer's discretion. The restricted package has most of the services standardized and allows for customer's to select them from a limited list of choices. Finally, the generic package has the least amount of service customization, where most if not all the services are standardized.

The authors go on to characterize the Mayo Clinic as a hospital that customizes its treatment on a one-of-a-kind basis, and where the patient has a considerable influence over the system in terms of scheduling appointments, and agreeing to various treatments plans, as well as in responding to treatment and showing additional symptoms. The National Jewish Center for Immunology and Respiratory Medicine is characterized as a center for the treatment of asthma and other respiratory illnesses, whereby a smaller service offering is presented, and patients have less of an influence in their treatment. Finally, Shouldice Hospital has been the object of several studies for its efficiency and quality in doing hernia repairs, whereby services are standardized to the point that several patients may go through the same process at the same time. Notably, the authors explain that a service firm's positioning on the matrix isn't static and that it may move to respond to a market opportunity. Ultimately, the main value of the author's contribution is that they relate service customization to degree of customer influence, which is a good start towards characterizing different providers.

Additionally, in our health care literature review we found some convergence with regards to criteria to help distinguish hospitals that are more alike than those that are different insofar as their structural characteristics are concerned.

The AHA in particular publishes an annual survey which characterizes hospitals and health organizations in general in terms of:

- **Primary service offering**: a list of 27 possible service types including general medical and surgical, psychiatric, acute long term, rehabilitation, etc.
- **System affiliation**: whether a hospital belongs to a system of hospitals with a non-unified asset ownership structure (e.g. a prominent system in Massachusetts is the Partners Healthcare System, Inc).
- **Bed size**: the total number of staffed patient beds
- **Control**: an organization may be classified in one of four types of control, namely federal government, state government, non government not-for-profit, and non government for-profit
- **State**: the state where the provider is located

Zinn and Mor (1998) offer a useful review of healthcare's literature findings with regards to the relevance of different hospital structural characteristics. Specifically:

- For-profit status has not been significantly related to outcomes. Similarly, more recent studies have determined that for-profit hospitals have virtually the same level of patient health outcomes as other types of hospitals (Kessler and McClellan 2002).
- Teaching hospitals have been associated with a clear lower patient satisfaction but not so with regards to other outcomes. Notably, hospitals characterized as major teaching hospitals is an important distinction to be made as it signals the difference between community hospitals (i.e. simpler patient cases) and specialized hospitals (i.e. more complex patient cases). Furthermore, it is common to see major teaching hospitals at the top of non-academic rankings such as "The US News".
- Hospital system membership has no clear association with outcomes. Similarly, other authors have noted that system membership is primarily a mechanism to create bargaining power and that hospital service offerings remain largely independent from one another (Luke 2006).
- Hospital size has no clear association with outcomes.

We value the usefulness of the above referenced studies which set forth typological characteristics to inform hospital research in general. However, we also refined our awareness of hospitals' significant degree of heterogeneity, both in terms of their environment as well as their internal characteristics, which ultimately compromise efforts to generalize results as evidenced by the persistence of conflicting study results. Table 4-4 comprises a selection of publications which highlighted hospital characteristics that compromise research designs and the generalizability of their results.

Table 4-4: Hospital characteristics that compromise research generalizability

Characteristic	Description	Reference
Comparability of hospital strategies in the same environment	Different organizations process the same environment differently and make different types of decisions, choosing to ignore and focus on different aspects of said environment.	(Weick 1969)
Comparability of hospital strategies in the same environment	Different hospitals are engaged in different missions (e.g. teaching, research, patient care) and the costs other than direct patient-related care are combined in the accounting system and allocated across billable services, thereby raising the total costs and introducing hospital-specific variation. Even hospitals with similar mix of services and patients, may differ greatly in efficiency and revenue generated.	(Tompkins, Altman et al. 2006)
Comparability of performance across hospitals	*"hospitals differ in the facilities and services they offer to patients. Some have emergency rooms, intensive care units, outpatient units, etc., while others have none of these facilities. This complicates the comparative process"*	(Morse, Gordon et al. 1974)
Comparability of payer mix across hospitals	Hospitals are engaged with multiple managed care plans which makes provider – insurance studies difficult	(Weiner and Lissovoy 1993)
Comparability of payer mix across hospitals	The same hospital may apply a mix of payment contracts with the same HMO. For instance, primary care visits and associate laboratory tests may be capitated, whereas referrals to specialists aren't.	(Berwick 1996)
Comparability of bargaining power across hospitals	Different sets of hospitals and insurance companies exhibit different power relationships which vary significantly across the industry.	(Douglas and Ryman 2003)
Comparability of procedural outcomes across hospitals	Comparing outcomes across hospitals even on specific procedures (e.g. bypass operation) is difficult because it depends on physician and hospital characteristics and on the underlying health of the patient.	(Cutler, Huckman et al. 2004)
Comparability of procedural outcomes across hospitals	Different hospitals design different systems of care for different procedures. Comparing hospital outcomes by procedure says nothing about the root causes of variation in quality.	(Blumenthal and Epstein 1996)
Comparability of accounting systems across hospitals	Difficult to compare service units across hospitals because each hospital has its own accounting system for allocating its various costs by department, type of service, and eventually individual line items in the charge master	(Tompkins, Altman et al. 2006)
Comparability of control structures across hospitals	The scope and control of medical departments and hospital wide governing bodies varies from hospital to hospital. Furthermore, each hospital varies in both the extent to which physicians are members of specific departments and, more importantly, the authority of department heads	(Sloan 1980)
Comparability of hospitals in general	Hospitals differ in terms of their organizational climate, the size of their operations, the technologies that they use, and the level of sophistication of their performance measurement system. There isn't an easy prescription as to what level of analysis to use when studying hospitals. In general, it calls for careful study of the situational factors of each hospital.	(Lawler 1981)
Difficult to establish dominant structural characteristics	One single organization may operate multiple organizational arrangements (e.g. participatory decision making; reporting structure; etc) which make it difficult to establish what is the dominant influence on structure.	(Miles, Snow et al. 1974)

> *"Will the 'real' American hospital please stand up? [...] No other country has such a heterogeneous collection of institutions comprising its hospital 'system.' In no other country is it as difficult to generalize about hospitals or to analyze their strengths and shortcomings."*
>
> (Shortell and Brown 1976)

Ultimately, given the heterogeneity amongst hospitals, some have questioned research and policy approaches that "*assume that health care organizations are equally competent to carry out the particular treatment*" (Flood 1994). Specifically, widespread implementation of policies is said to be hindered by the "*heterogeneity of practice settings, with their varying data systems, organizational forms, and degrees of readiness to change*" (Hussey, Eibner et al. 2009). Similarly, "*the evolving organizations are too different to put forward any isolated techniques as uniform resolutions to management problems*" (Evashwick and Weiss 1987).

Furthermore, others have acknowledged that hospital specific organizational structures may be relatively efficient and/or more conducive to higher performance, however, in the absence of the necessary in-depth data it has remained impossible to "*gauge impacts of [a hospital's] organization on various dimensions of performance*" (Sloan 1980). Such is in line with a recent group of health care experts, charged with setting a research agenda aimed at improving the US health care system, who defined as one of the highest research priorities the identification of key organizational characteristics from high-performing hospitals (Fernandopulle, Ferris et al. 2003).

As a result, on one hand we are further reminded of the importance of the research questions this thesis posed in Chapter 3, namely: ***Can one create an enriched understanding of hospital enterprise architecture?*** and ***Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?*** On the other hand, considering hospitals' fragmented environment (i.e. regulation, payment, delivery), and their heterogeneous characteristics, we determined

that our research design would have to consist of an in-depth exploratory case study of a high-performing hospital.

4.5.3 Identifying hospital candidates for in-depth case study

In the previous subsection we identified a call for research targeted at studying in-depth high performing hospitals. In chapter 2 we conducted a longitudinal multidisciplinary literature review of hospital performance measurement studies, and while informed by lean enterprise principles, we defined eight performance dimensions according to which hospital performance should be evaluated[51]. Thus, with regards to performance we will leverage these performance dimensions to sample hospitals for our research. However, given the issues identified regarding hospital heterogeneity, including differences in service customization and degree of patient influence, we returned to the literature to further refine our hospital sampling. Table 4-5 describes 18 publications from 1933 to 2010 which essentially support large multispecialty group practices as the preferred model.

Table 4-5: Evidence supporting large multispecialty group practices as a preferred model

Recommendation(s)	Reference
Medical service should be more largely provided by groups of physicians and related practitioners, and organized so as to maintain high standards of care and to retain the personal relations between patients and physicians.	(Falk, King et al. 1933)
An effective hospital is one that is able to treat the whole patient without need of transferring a patient to receive emergency treatment or in the event of complications associated with a particular disease. Furthermore, a hospital should be able to invest in medical innovations as per evidence-based-medicine so as to deliver high-quality care.	(Morse, Gordon et al. 1974)
The ideal system would allow for financial integration, common or shared data records, a case manager responsible for overseeing each patient's care, and more importantly, effective multidisciplinary teamwork so as to deliver effective, comprehensive, and integrated ongoing services.	(Vladeck 1987)
More integrated systems have better financial performance and score better overall relative to competitors (e.g. the greater the degree of	(Shortell, Gillies et al.

[51] The eight hospital performance dimensions were identified as follows: financial, operational, quality, customer satisfaction, employee satisfaction, strategy and operations alignment, social equity, and organizational learning.

Recommendation(s)	Reference
overall perceived physician-system integration, the greater the system's inpatient productivity).	1994)
Group practice allows for better physician coverage, more physician interaction, increased access and ease of specialty referrals, a wider array of ancillaries, use of nonphysician providers, and the convenience of one-stop shopping.	(Burns 1995)
Middle sized organizations are best suited for prospective payment models as they are neither too small (i.e. prone to spend less given inability to change system significantly) nor too large (i.e. too bureaucratic and unable to trace performance).	(Berwick 1996)
The benefit of larger group practices is beyond the increased complexity of medicine. Group practices aggregate human resources and capital that physicians increasingly need. These include access to specialists, support staff, and complex services, such as outpatient surgical & diagnostic care.	(Blumenthal 1996)
Large group practices are able to curb physician behavior by increasing formalization and specialization, as manifested in formal monitoring and peer review.	(Zinn and Mor 1998)
An integrated healthcare delivery system that is more integrated has more potential to provide accessible coordinated care across the continuum and appears to be associated with higher levels of inpatient productivity, greater total system revenue, and greater total system operating margin than are found in a less integrated system.	(Lin and Wan 1999)
Physician group practices can provide the scale, incentives, and information platforms to support a more rapid penetration of clinical practice improvements.	(Coye 2001)
Hospitals can reduce the power of buyers by integrating with physician groups that possess strategic competencies.	(Douglas and Ryman 2003)
Focused factory settings (e.g. carveout facility providing heart care) are inadequate for patients with complex, multisystem health problems.	(Cortese and Smoldt 2007)
There is evidence suggesting that large physician groups have better performance, and would thus be more appropriate to accommodate a shared accountability environment.	(Fisher, Staiger et al. 2007)
Hospitals that are more fully integrated provide higher quality and more efficient care than do smaller hospitals in the context of capitation.	(Tollen 2008)
Prospective payment models work well with multispecialty group practices, as opposed to individual physicians or smaller practices. Group practices can shield physicians from ethical issues of personal financial gain and enable them to focus on quality of care.	(Crosson 2009)
The health system should move towards integrated hospitals that encompass all the skills and services required across the full continuum of each medical condition, including patients with multiple chronic conditions. Such hospitals should offer outpatient and inpatient care, testing, education, and rehabilitation.	(Porter 2009)
Provider-led organizations should align incentives and accountability for providers along the continuum of care (i.e. multiple services and patient	(Rittenhouse, Shortell et al.

Recommendation(s)	Reference
populations). To that effect, multiple forms are adequate, including large integrated systems and multispecialty practice groups that own a hospital.	2009)
In reforming healthcare's delivery system, integrated organizations are proposed as the preferred model to reduce costs and improve patient outcomes.	(Chernew, Sabik et al. 2010)

Several of the authors in Table 4-5 are contemporary prominent healthcare academics, policy makers (e.g. Donald Berwick) and/or practitioners (e.g. the former CEO of the Mayo Clinic, Denis Cortese, and the Executive Director of The Permanente Foundation, Jay Crosson), and management academics (e.g. Michael Porter). Throughout the approximate 80 years of publications there was the consistent recommendation that care ought to be delivered in group practice environments so as to reduce coordination complexity, increase the adoption of evidence-based-medicine, allow for financial integration, and data integration.

Over time, the concept of a larger group practice evolved to qualifying the need for facilities capable of delivering multispecialty services that covered the whole patient lifecycle from primary care to specialist care, so as to once again facilitate coordination and improve care, but also improve access, convenience, and the ability for providers to become accountable for all of a patient's care. Moreover, multispecialty care as opposed to the *focused factory* concept, is better equipped to address the needs of those patients suffering from one or more chronic diseases.

Furthermore, larger multispecialty group practices are considered better able at curbing physician behavior, and also capable of shielding them from perverse financial incentives by instituting a salaried model, which allows them to focus on patient care. Finally, multispecialty group practices that own or are closely related to a hospital are better able to negotiate with insurance companies.

All in all, our review of the literature concluded that large multispecialty group practices are considered more capable of higher performance given health care's environment and therefore constitute the preferred care delivery model.

4.6 Chapter 4 Summary

In this chapter we described how the US health care system is commonly characterized as a *cottage industry* not only because of the proliferation of providers in its delivery system but also because of the fragmented regulatory and payment environments. Figure 4-6 is a summary representation of the multiple levels of analysis and multiple stakeholders inherent in the provision of medical care which embodies a complex and technically sophisticated enterprise (Robinson and Casalino 1996). As noted, different stakeholders have different value propositions and are presented with different value requirements which aren't necessarily aligned with one another and thus present considerable sources of system inefficiency as well as pressure for hospitals in particular.

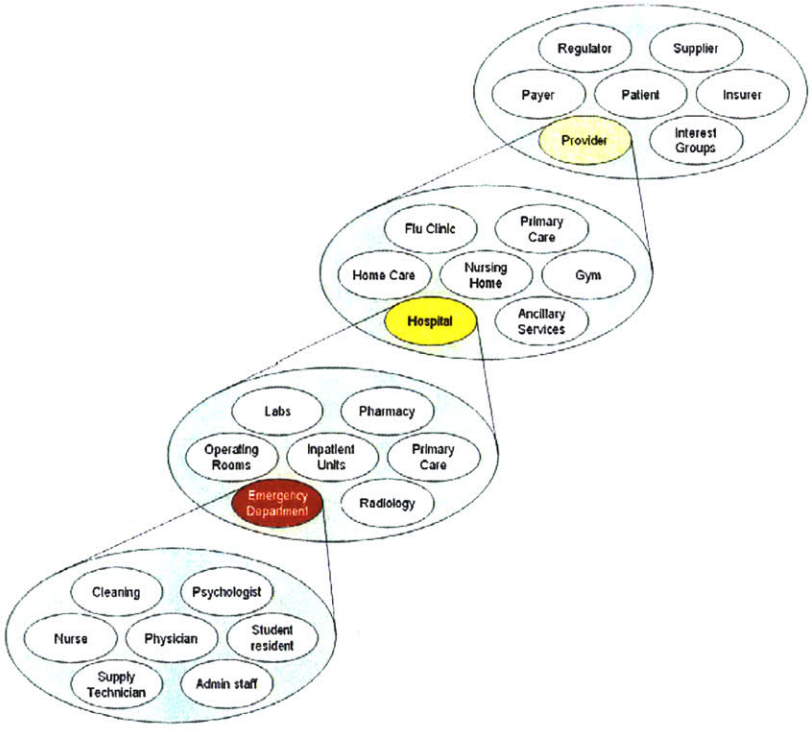


Figure 4-6: Multilevel stakeholder decomposition of a healthcare system (Oliveira, Nightingale et al. 2010)

We identified that hospitals represent the largest source of health care expenditure both in the US and elsewhere, and are considered to be a top research priority. However, our literature review also found that hospital comparability studies have been hindered by the

heterogeneous characteristics of hospitals themselves as well as the external environments they are embedded in. As such, there have been calls for research specifically targeting high performing hospitals so as to identify their key organizational characteristics and doing so in the context of in-depth studies. Therefore, hospitals constitute the focal unit of analysis in this research, whilst nonetheless including macro level contextual considerations (e.g. regulation, payment models, etc) and micro level of care delivery (e.g. emergency department, inpatient service units, etc). All in all, we found further evidence of the importance of the research question posed in this thesis, and the last two questions in particular, namely:

- ***Can one create an enriched understanding of hospital enterprise architecture?***
- ***Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?***

Finally, we examined the literature so as to identify which type of hospitals to include in our in-depth case sampling, and concluded that large multispecialty group practices are considered more capable of higher performance given health care's environment and therefore constitute the preferred care delivery model.

The next chapter describes in further detail the research design for each of the research questions posed in this thesis.

5. Research Roadmap

This chapter is a review of the research strategy used to collect and analyze data from multiple hospitals so as to address our research questions, whilst informed by extensive literature pertaining to research methodology. Figure 5-1 provides an overview of the thesis' research map.

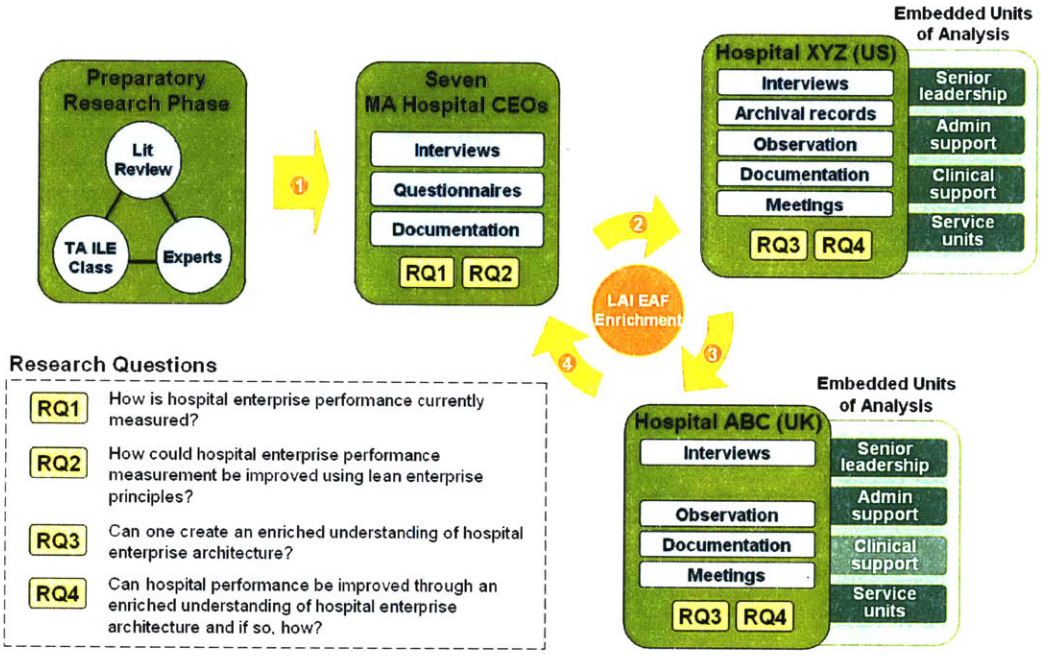


Figure 5-1: Research Roadmap[52]

We begin by describing the construct of methodological fit and how it was adopted as an overarching design criterion for this research. Next we discuss our research strategy which includes the selection of health care as the domain of interest, followed by a brief overview of the preparatory research phase, and the sampling of seven Massachusetts hospitals, and two in-depth cases of high performing multispecialty hospitals located in the US and the UK respectively. Several recommendations to strengthen case study research are discussed, and detailed information is shared in terms of the sampling

[52] All hospitals included in this research are referred to with pseudonyms to protect the identity of the enterprises in each case study. In particular, much of the in-depth cases analysis is sensitive, so measures were taken to protect Hospital XYZ and Hospital ABC's identity and disguise any identifying data.

rationale for each of the four research questions posed in this thesis. Finally, the data collection and analysis techniques used in this thesis are described at length.

5.1 Designing for Methodological Fit

Edmondson and McManus (2007) defined a framework for assessing and promoting methodological fit as an overarching criterion for ensuring quality field research. Methodological fit results from the consistency among research question(s), prior work, research design, and contribution to literature. Notably, several other scholars have set forth very useful contributions in research design and field research methods in particular (Campbell and Fiske 1959; Glaser and Strauss 1967; Yin 1981; Eisenhardt 1989; Ragin 1989; Yin 1994; Hackman 2003) and these were also included in the definition of this thesis' research strategy. For instance, two field research methodology schools of thought that lie at opposite ends of the spectrum are those of case-study research and grounded theory. Proponents of the latter (Glaser and Strauss 1967) advocated a *blank slate* approach, whereby the researcher entered the field with no prior knowledge and allowed phenomena of interest to emerge from the data. Conversely, proponents of the former (Yin 1994) advocated that a preliminary literature review and theoretical framework should be devised prior entering the field, and that it should cover most if not all the key propositions to be studied. However, while on one hand a *blank slate* is both difficult to ascertain and potentially resource intensive to develop worthwhile research (Ragin 1989), on the other hand relying solely on the literature ahead of time to identify a research problem may also be restrictive. Nonetheless, both schools of thought offer methods which were contemplated and integrated in this research design, as prescribed in criterion of methodological fit.

The criterion of methodological fit proposes as necessary an alignment between the theoretical maturity of the phenomena of interest at hand and the data evidence and methods embedded in a research design. Specifically:

> *"theory lies across a continuum, from mature to nascent.* ***Mature theory*** *presents well-developed constructs and models that have been studied over time with increasing*

precision by a variety of scholars, resulting in a body of work consisting of points of broad agreement that represent cumulative knowledge gained. ***Nascent theory****, in contrast, proposes tentative answers to novel questions of how and why, often merely suggesting new connections among phenomena.* ***Intermediate theory****, positioned between mature and nascent, presents provisional explanations of phenomena, often introducing a new construct and proposing relationships between it and established constructs*"

(Edmondson and McManus 2007).

In reviewing articles that produced original data collected in real organizations, the authors determined that there is a tendency in terms of the alignment of theoretical maturity and the type of data evidence collected (see Figure 5-2). Whereas mature theory enables precise, quantitative research design, intermediate theory leverages hybrid designs of both qualitative and quantitative data, and finally, nascent theory explores phenomena through qualitative data.

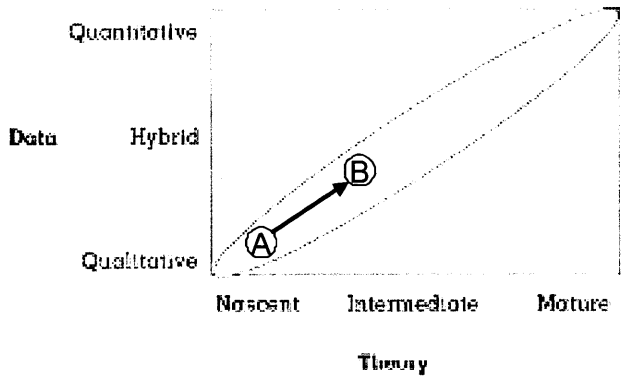


Figure 5-2: Methodological Fit Tendency (adapted from (Edmondson and McManus 2007))

Notably, other systems thinkers have recommended the use of hybrid research designs in the study of complex systems. For instance, some advocate the use of case based research to understand the context in which enterprises operate as well as their inner workings while flexibly leveraging both quantitative and qualitative data derived from in-depth engagements with real organizations (Rhodes, Lamb et al. 2008). Moreover, organizations "*are neither purely objective nor purely subjective phenomena*" (Astley and Ven 1983) as they are populated with individuals who may behave in unpredictable ways, and the structure of said organization may give rise to emergent phenomena.

Similarly, healthcare researchers have recommended the use of both quantitative and qualitative methods to evaluate differences in hospital performance (Williams, Schmaltz et al. 2005) Finally, Rhodes et al (2008), also note that grounded theory leads to a more accurate process of discovery given its systematic and concurrent process of data collection and analysis. Other scholars, although only in the context of organizational theory (as opposed to systems thinking) had already expressed similar views and requested "*very intensive and very thorough case studies*" (Campbell 1977) to explore the relationship between organization designs and effectiveness outcomes (Lewin and Minton 1986).

Determining what constitutes a Lean Enterprise Architecture, or any theory of the business, may sound deceptively simple but it involves several years of empirical experimentation before reaching a clear, consistent, and valid theory for a given organization (Drucker 1994). Hence, given the nascent phase of development of enterprise architecture from a lean enterprise perspective (Nightingale 2009) a key motivation for this research was to empirically and theoretically enrich MIT's emerging Nighintgale-Rhodes Enterprise Architecture Framework (NREAF). As such, this thesis is situated between enterprise architecture's nascent theoretical maturity and that of lean enterprise thinking intermediate theory. Therefore, our research study was primarily designed to be exploratory and inductive (i.e. point A), but also was deductive in leveraging existing literature (i.e. point B). For instance, our theoretical proposition that an enriched understanding of hospital enterprise architecture can improve hospital performance, emerged from the empirical data. Finally, the iteration between inductive theory development and deductive theory testing wasn't the product of a sequential progression (i.e. literature review -> research question -> data collection -> analysis -> publication) but rather a series of iterative and cyclical steps, that allowed for the methodological fit to be adjusted as new findings emerged from the data (see Figure 5-3).

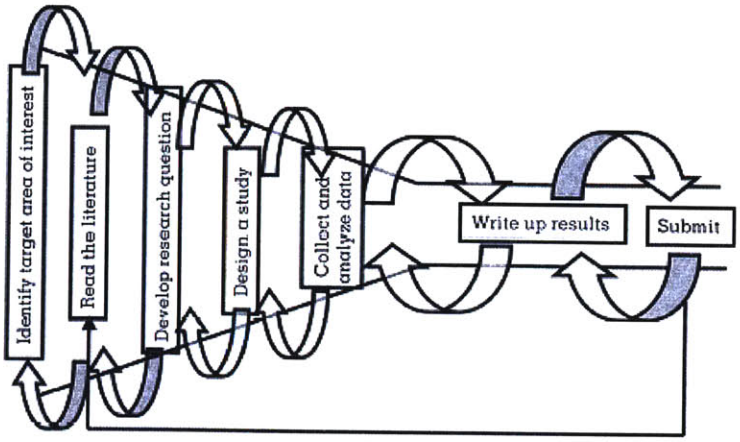


Figure 5-3: Engineering systems research as an iterative and cyclic process (adapted from (Edmondson and McManus 2007))

5.2 Research Strategy

The case study is a research strategy that neither implies a particular type of evidence nor a particular type of collection method (Yin 1981). Data evidence can be both quantitative and qualitative, and may result from multiple collection methods (e.g. interviews, observation, archival records, etc). As a research strategy the case study allows for us to study a contemporary phenomenon in its real-life context where the variables under study are both difficult to quantify and beyond our control (Yin 1994). However, the purpose of a case study research strategy is not to provide for statistical generalization, but rather analytic generalization whereby case selection criteria are of paramount importance (Yin 1981). Furthermore, a case study treats an organization as a whole entity rather than a collection of parts, and in doing so, explores the relations between the parts of a whole within the context of the whole (Ragin 1989).

5.2.1 Selecting health care domain

In Chapter 1 we described that the overarching motivation for this research is to respond to the National Academy of Engineering and the Institute of Medicine's joint call to promote the application of "*principles, tools, and research from engineering disciplines*

associated with the analysis, design, and control of complex systems" (Reid 2005). Furthermore, we explained how health care executives traditionally relegate *lean* to a process level discussion focused on efficiency gains, which prevents them from "*doing the right things and doing things right*" (Drucker 1963). As such, we also set ourselves to help elevate the traditionally narrow hospital definitions of lean health care and explore the broader concepts of lean enterprise principles and EA while enhancing our knowledge of hospitals' socio-technical complexity and underlying performance. Ultimately, the healthcare domain is the domain of focus for this research.

The focus on a single domain has direct implications in establishing cross-domain validity[53]. However, several scholars also point to the potential limitations of studying multiple domains in a single research study. To begin with, studies across domains may reflect industry differences and their impact on organizations rather than the specific influence of an organizational phenomena of interest (e.g. process) (Galbraith 1974). Similarly, much of the variation in comparative studies has been attributed to differences in organizational domain (Van de Ven and Ferry 1980). Also, attempts to address multiple domains tend to address extremely grand categories, and while adopting a relatively universal view, ultimately undermine the value of the resulting findings (Hambrick 1984). Ultimately, organizational theories (and indeed systems thinking theories) would appear to be enhanced if generalized across domains, but given the enunciated problems scholars suggest that researchers first examine organizations in a single domain, and also carefully sample using key factors within the chosen domain (Ginsberg and Venkatraman 1985).

With that in mind we underwent a preparatory research phase, and devised two different case sampling approaches to address our research questions. These are described in detail in the next subsections.

[53] Research validity is discussed in further detail in section 5.2.5

5.2.2 Preparatory research phase

As illustrated in Figure 5-1 an initial preparatory research phase took place so as to gain additional insight into the health care domain and enterprise architecture systems thinking.

Over the course of the author benefited from the opportunity of being Teaching Assistant (TA) for Prof. Deborah Nightingale's graduate course "Integrating the Lean Enterprise" listed in both the engineering and management course catalogues[54]. Already as a masters student he had taken the course himself and leveraged it in his master thesis which studied two hospitals' vendor managed inventory systems, and he was first introduced to hospital enterprises. As a TA he helped establish and supervised semester long class projects with Massachusetts health care organizations, which included three different hospital sites in the first semester alone, followed by an additional eight throughout the remainder of this thesis' duration. Often times he would engage directly with the senior leadership of said hospitals and discuss research ideas beyond class materials.

Furthermore, he took healthcare graduate classes at Harvard's School of Public Health, JFK School of Government, and Harvard Business School. Additionally, he participated at healthcare workshops held at the MIT where several industry leaders discussed prominent issues they were facing, and different solutions they were attempting. Finally he conducted in-depth longitudinal literature reviews on various disciplines as featured throughout this thesis' chapters. Notably, the literature reviewing and engaging with industry leaders, were continuous exercises throughout this research, as described in the previous section.

5.2.3 Sampling of seven Massachusetts hospitals

In Chapter 4 our healthcare literature review found that hospital comparability studies have been hindered by the heterogeneous characteristics of hospitals themselves as well as the external environments they are embedded in. For instance, to compare hospitals and draw conclusions about their effectiveness "*without taking into account possible differences in environment or goal structures is of dubious value*" (Shortell and Brown

[54] The author was awarded MIT's Graduate Teaching Award in 2010 for his role as a TA in this class.

1976). In particular, hospital competition is said to be regional, and healthcare scholars recommend that one select a geographic region within which the studied hospitals compete for similar resources (Ketchen, Thomas et al. 1993). Notably, healthcare hospital studies have commonly focused in a single state to avoid regulatory, payment, labor, and patient environment variations (Grosskopf and Valdmanis 1987; Shortell and Hull 1996; Ashmos, Duchon et al. 2000). As a result, our first two research questions have a hospital sample primarily[55] drawn from the US state of Massachusetts.

Three main reasons support the decision to sample hospitals from Massachusetts. First, Massachusetts was the first state to require all residents to have some form of health insurance coverage, and hence diminishing the likelihood of uninsured patients affecting hospital performance. Second, as noted in Chapter 4, the state of Massachusetts is one of the top three states in the US for the quality of its healthcare, and indeed comprises several nationwide provider leaders on various medical and surgical specialties. Third, Massachusetts also represented a convenience sample given that MIT is here located.

Having focused on Massachusetts, we next took into account the different characteristics of health care organizations. Specifically, health care organizations (e.g. ambulatory care, psychiatric, long term care, acute care, etc) differ in their goals, tasks, services, as well as in their patients, physicians, and payer mix (Donabedian 1988; Flood 1994). These differences can, in turn, lead to different interpretations and definitions of performance. Notably, in chapters 1 and 4 we determined that hospitals would constitute the focal unit of analysis in this research.

The American Hospital Association (AHA) Hospital Guide (AHA 2008) characterizes hospitals and health care organizations in general in terms of their primary service offering, system affiliation, bed size, control, and state. Also based on the literature we further added as a characteristic whether or not a hospital has a *major teaching hospital* status. Table 5-1 below is an overview of the analysis made on the AHA Hospital Guide

[55] The two in-depth case studies were initially devised to address the third and fourth research questions. However, phenomena of interest emerged pertaining to the first two research questions as well, and hence the in-depth case findings also inform the first two research questions.

in terms of Massachusetts. Upon inspection one determines that the prevalent type of hospital in Massachusetts is "General Medical Surgical" with a total of 69 hospitals, which represents 57.5% of all MA hospitals. Table 5-2 is an overview of the "General Medical Surgical" hospitals characterized in terms of the hospital typology mentioned previously.

Table 5-1: Massachusetts primary service offering distribution (calculated from (AHA 2008))

Primary service offering	Control						Total	
	For profit	Federal	Non federal - non profit					
			state	private	church	local gov.	#	%
Cancer				1			1	0.8%
Children's general				1			1	0.8%
Children's chronic disease			1				1	0.8%
Children's other specialty				2			2	1.7%
Children's orthopedic				1			1	0.8%
Children's rehabilitation				1			1	0.8%
Eye, ear, nose, and throat				1			1	0.8%
General Medical Surgical	**7**	**2**	**2**	**52**	**5**	**1**	**69**	**57.5%**
Hospital unit of institution			1	3			4	3.3%
Long Term Care	6		3	5	1		15	12.5%
Orthopedic				1			1	0.8%
Psychiatric	5	1	5	4			15	12.5%
Rehabilitation	4			1			5	4.2%
Other specialty		1	1				2	1.7%
Alcohol				1			1	0.8%
Subtotal	22	4	13	74	6	1	120	

Table 5-2: Massachusetts general medical surgical distribution (calculated from (AHA 2008))

Hospital Bed Size	System Affiliation		No System Affiliation		Total %
	teaching	no teaching	teaching	no teaching	
Small Hospital (<= 99 beds)	1.5%	**19.7%**	0.0%	**7.6%**	28.8%
Medium Hospital (100 to 399 beds)	**7.6%**	**15.2%**	**4.5%**	**31.8%**	59.1%
Large Hospital (400+ beds)	**7.6%**	1.5%	1.5%	1.5%	12.1%
Subtotal	17%	36%	6%	41%	100.0%

Upon inspection of the most predominant hospital types it was determined that the hospital sample to be drawn would include one hospital from each of the following types:

- Small hospital with system affiliation and no academic teaching status
- Small hospital without system affiliation and no academic teaching status
- Medium hospital with system affiliation and academic teaching status
- Medium hospital with system affiliation and no academic teaching status
- Medium hospital without system affiliation and with academic teaching status
- Medium hospital without system affiliation and no academic teaching status
- Large hospital with system affiliation and academic teaching status

The seven hospital sample constitutes 10% and is representative of 93.9% of all general medical surgical hospitals in Massachusetts. Notably, hospitals with 1.5% or less representation weren't included in the sample (i.e. 6.1% of all hospitals in total). All seven hospitals had a positive operating margin in 2005 and were accredited by the Joint Commission. Finally, hospitals were also selected on the basis of their Chief Executive Officer being available to be administered the research instruments face-to-face.

5.2.4 Sampling of two in-depth cases

In Chapter 4 we identified calls for research specifically targeting high performing hospitals so as to identify their key organizational characteristics and doing so in the context of in-depth studies. Therefore, hospitals constitute the focal unit of analysis in this research, whilst nonetheless including macro level contextual considerations (e.g. regulation, payment models, etc) and micro level of care delivery (e.g. emergency department, inpatient service units, etc). Furthermore, we concluded that large multispecialty group practices are considered more capable of higher performance given health care's environment and therefore constitute the preferred care delivery model.

Earlier in section 5.1 we noted that both systems thinking and healthcare scholars have recommended the use of in-depth case based research with real organizations whilst using a hybrid research design, so as to better understand complex enterprises in terms of their

context and inner workings. We also noted that the nature of our research questions requires a mix of methods used in the development of nascent and intermediate theory, namely allowing for phenomena of interest to emerge from the data, but also leveraging existing theoretical constructs to guide decisions in terms of case sampling and interpretation of data (i.e. inductive and deductive iterative cycles).

5.2.4.1Strengthening in-depth case study feasibility and generalizability

A single case study is deemed appropriate "*when the case represents an extreme case or unique case*" (Yin 1994). Also, a single case controls for broad contextual factors and allows one to focus on the differences among units within the same organization (Tsai and Ghoshal 1998). Finally, the purpose of case study research isn't to provide statistical generalization, but rather analytic generalization (Yin 1994). However, it is also true that single case based research is prone to generalization limitations (Pugh, Hickson et al. 1969; Etzioni 1975; Eisenhardt 1989; Leonard-Barton 1990; Yin 1994; Edmondson 1999). In turn, the conduct of in-depth case studies requires extensive resources and time both in terms of the researcher and the organization being studied, and hence even more so in the context of multiple case studies, which can be beyond the means of a single student (Yin 1994). Additionally, access to performance data on privately-held firms is severely restricted and senior leadership may be reluctant to share sensitive information which isn't publicly available (Dess and Robinson 1984). To address these issues several authors have set forth different recommendations which were contemplated and adopted in this thesis' research design:

- **Theoretical sampling and literature comparison:** One of them we have already mentioned, namely the use of existing theoretical considerations to guide decisions about sampling and variables to include in a study (Hambrick 1984; Edmondson and McManus 2007). Such not only addresses the issue of reducing unnecessary data collection efforts but also allows the researcher to develop middle range theory whereby propositions are formulated concerning subcategories of organizations (Etzioni 1975). Similarly, the ongoing comparison of findings with the literature allows to sharpen construct definitions as well as generalizability (Eisenhardt 1989). Moreover, as the number of reinforcing

propositions increases so does the degree of a theory's confirmation (Lee 1989).

- **Explore organizational units variation:** Another stream of recommendations is to fully explore the diversity that an in-depth case has to offer and theoretically sample different organizational units according to distinctive characteristics (e.g. function, size, etc) and in particular those that exhibit phenomena of interest (Krackhardt and Brass 1994; Edmondson 1999). Moreover, units should be sampled on the basis of variation in the independent variables rather than randomly and hence test whether or not a proposition is valid (Daft and Macintosh 1981)
- **Explore organizational units interaction:** Others also recommend that organizational units should be studied in the context of the macro level (e.g. whole organization) while identifying and assessing unique design patterns of each unit, and determining how different units are linked together to contribute to overall performance of the organization (Van de Ven and Ferry 1980). In particular, both formal and informal ties between units should be carefully studied to better understand information and resource flows (Tsai and Ghoshal 1998; Hansen 1999). Finally, the ability to study organizational units interaction makes the analysis of complex system's behavior more manageable, as one needs not study all possible interactions (Glazner 2009).
- **Explore three adjacent levels of analysis:** Furthermore, the use of constructs at adjacent levels of analysis (e.g. individual, department, organization) allows "*to begin the process of bootstrapping to ever-better explanations of one's phenomena*" (Hackman 2003). Specifically, the interest in phenomena at a particular level of analysis doesn't provide guarantees that the most dominant variables to shape said phenomena will be found at the same level. Therefore, it is recommended that the researcher collect data from higher and lower levels of analysis to identify factors which would otherwise remain hidden from view. However, the author also notes that "*to try to handle more than three simultaneously is almost certainly to enter upon an analytic nightmare*" (Hackman 2003), but also warns against skipping levels of analysis, as such replaces explanation with speculation.

- **Explore polar cases:** Yet another recommendation is that of using organizational units that exhibit *polar behavior*. In other words, the researcher divides the sample of organizational units into low and high performing, whereby the high performing unit is expected to reveal relationships closer to the emergent theory than the lower performing unit (Drazin and Ven 1985; Eisenhardt 1989).

The use of multiple levels of analysis, multiple organizational units, and polar cases, ascribe to a useful representation of the different types of case study research designs (see Figure 5-4). Yin (1994) distinguishes case studies in terms of the number of case studies, but also whether they use a holistic or embedded design. The former studies an organization(s) as a whole, whereas the latter incorporates more than one unit of analysis of the organization(s).

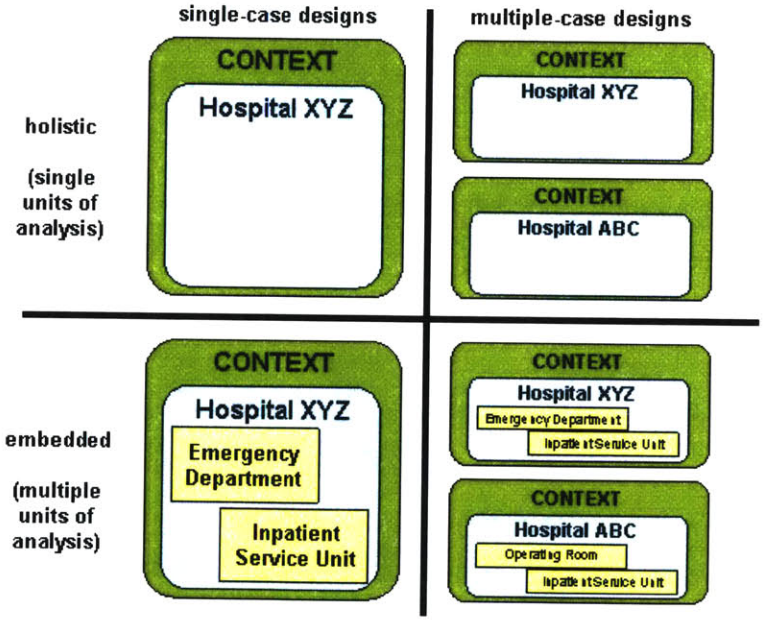


Figure 5-4: Case Study Design Types (adapted from (Yin 1994))

All in all, the listed research design recommendations improve research validity of a single in-depth case study. However, the fact still remains that a better scenario is one where the same recommendations are applied with similar rigor to two or more in-depth case studies, so as to test whether literal replication occurs across cases (i.e. phenomena of interest is found under similar conditions) (Yin 1994). In the context of this thesis in

particular, the case study design followed was the one in the lower right corner in the above figure. Next we describe in more detail each of the in-depth cases, as well as the initial embedded units considered. Notably, as data collection and analysis progressed, and phenomena of interest emerged, additional embedded units were added to each hospital's case study.

5.2.4.2 Sampling of Hospital XYZ and Hospital ABC

In line with the health care literature's recommendations both Hospital XYZ and Hospital ABC are multispecialty hospitals, ranked in the top 1% of medical surgical hospitals in the US and UK respectively, with positive operating margins, and regarded as leaders in several publicly reported clinic process measures (see Table 5-3). Furthermore, they scored highly in terms of publicly available data on four of the performance dimensions defined in the context of our first two research questions, namely finance, operations, quality, and patient satisfaction.[56]

However, both organizations were beginning to struggle with distinct nationwide issues and were unsatisfied with the results of their traditional lean solutions. Having been introduced to the core concepts from this thesis' Chapter 2 (and to some extent Chapter 3), senior leaders of Hospital XYZ and Hospital ABC were very supportive of conducting in-depth exploratory case studies. The intent was not to compare the hospitals to one another but rather to explore and further our understanding of the inherent complexity of high performing hospitals, to demonstrate the benefits of a systems thinking research approach, and determine to what extent literal replication across both cases could be established. Notably, Hospital XYZ's unique characteristics, including electronic medical records, which were integrated with a billing system, together with its closer proximity, allowed for a deeper exploration of our phenomena of interest[57].

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[56] Data on the remaining four dimensions became available as part of each in-depth case study (i.e. employee satisfaction, social equity, organizational learning, and strategy/operations alignment). Notably, performance data which is publicly reported is done so at a high level (e.g. hospital annual reports) and only through in-depth analysis is one able to disaggregate said data and begin understanding and assessing actual enterprise performance.

[57] For further detail on the data collection for each in-depth case please refer to section 5.3.2

In line with case study guidelines (Yin 1981), and together with senior leaders of both organizations, we sharpened our research projects by asking two preliminary central questions as follows:

- **Hospital XYZ**: How to speed patient flow in the Emergency Department?
- **Hospital ABC**: How to increase productivity in the Main Operating Rooms?

As noted both central questions reflected the nationwide issues that each organization in particular was facing. In the US it was the case of emergency department overcrowding, whereas in the UK it was an overarching concern with a new National Health Service (NHS) policy called 18 Weeks. Essentially, 18 Weeks increased demands upon hospital operations as it represented the maximum wait time from a patient referral to definitive treatment, and in the event of it not being met, the hospital wouldn't be paid for treating that patient, and would have to face an audit and additional potential penalties. As a result they were looking for ways to maximize the throughput of their Main Operating Rooms[58].

Table 5-3: Hospital XYZ and Hospital ABC Key Characteristics (2006 data)[59]

Characteristic	Hospital XYZ (US)	Hospital ABC (UK)
Ownership	Non-profit physician owned group practice	Non-profit National Health Service (NHS) Foundation Trust
Type	Multispecialty tertiary urban hospital	Multispecialty tertiary urban hospital
Total beds	300	850
Total staff	4000	5500
Emergency department visits	36,000	140,000
Total income	$700,000,000	$750,000,000
Operating income	$50,000,000	$20,000,000
Major teaching hospital	Yes	Yes
Salaried model	Yes	Yes

[58] Operating Rooms in the UK are called Theaters and will be referred to as "Operating Rooms" throughout the remainder of this thesis. Furthermore, hospitals organize their operating rooms (ORs) differently, but generally tend to cluster them in some fashion. At Hospital ABC, the Main ORs were the largest cluster.
[59] Some of the values were approximated so as to further protect the identity of the organizations. Similarly, information pertaining to their geographic location within the US and UK has been withheld.

Hospital XYZ

Hospital XYZ is a unique case in the US which gathers several characteristics favored by health care experts for future health care delivery models. Beyond being a multispecialty organization, it is one that is led and owned by physicians, and was founded as a physician group practice that then built its own hospital. Additionally, all care practitioners are Hospital XYZ employees and are salaried. Furthermore, Hospital XYZ offers integrated health care services where patients are treated in a team based care practitioner environment, and can have the necessary ancillary tests done onsite, as well as see both primary care and specialist physicians, thus effectively covering the patient's lifecycle, and making Hospital XYZ a recognized leader in caring for patients with multiple chronic diseases, as well as those needing highly specialized care (e.g. liver transplant, open heart surgery, etc).

> "*[Hospital XYZ]* ***is sort of a real duck****. It is the exception, not the rule, where you have a provider organization that includes physicians, includes hospitals, includes ancillary services, all in one organization. There are lots and lots of physician organizations out there, anywhere from single physician group practices to large multispecialty group practices like [large group A], that don't have their own hospital, they have some ancillaries, but basically they have a large outpatient practice, so there is quite a range out there, and you also have stand alone ancillary providers*"
>
> Hospital XYZ Chief of Strategy

> *"it really is a physician led group practice, and the* ***group practice decides what it needs to take care of the patients that it wants to take care of****, and* ***the hospital is an extension of the group practice****, as opposed to all the other places in [city centre] where the hospital existed and individual physician practices developed to support the hospital"*
>
> Hospital XYZ Chief Operating Officer

Finally, Hospital XYZ was fully committed to this research in multiple ways. Extensive access was granted to senior leadership, operational managers, physicians, nurses, as well as supporting services, and sensitive operational and financial data systems.

Hospital ABC

Hospital ABC leads by far performance assessments from the UK's National Health Services (NHS) and as a Foundation Trust is allowed to reinvest any profits stemming from its operations (as opposed to returning the surplus to the NHS). As noted in Table 5-3, Hospital ABC is a multispecialty tertiary urban hospital associated with a leading university and providing comprehensive local services to an economically challenged and ethnically diverse population, whilst at the same time building clinical excellence in a portfolio of specialist services (e.g. liver transplants, neurosurgery, etc).

Access to Hospital ABC included senior leadership and extensive access to operational managers, physicians, nurses, as well as supporting services. Notably, all patient medical records were in paper format and all workflow heavily relied on paper, and although data access had been granted, its underlying infrastructure limited our ability to collect such data and prompted alternative data collection and analysis methods.

5.2.5 Designing for validity

This thesis' research design reflects a concern towards establishing both validity (i.e. construct, internal, and external) and reliability.

With regards to construct validity we used multiple sources of evidence (more so in our in-depth cases of Hospital XYZ and Hospital ABC, as per Figure 5-1) to triangulate our data (Jick 1979) and establish our chain of evidence (i.e. detailing how findings were derived from the analysis of evidence). In terms of internal validity, the analysis of Hospital XYZ determined that different service units had different performance in their interactions with the emergency department, which prompted the pattern matching of emergent conditions of each unit so as to explain the performance variability. External validity to domains beyond healthcare was sought through the in-depth longitudinal literature reviews presented in chapters 2 and 3. Within healthcare, and hospitals in particular, we conducted two in-depth case studies of leading multispecialty hospitals (one based in the US, and another in the UK), and we interviewed senior leadership of 7 hospitals in Massachusetts, and shared our findings with domain experts. All of the

hospitals included for study were selected on the basis of health care literature recommended criteria (i.e. chapter 4) and supplemented primarily with third party publically available data.

Finally, reliability was established in the study of the 7 Massachusetts hospitals whereby the same interview protocol and quantitative instruments (i.e. three questionnaires) were administered in largely similar settings and subsequently analyzed using the same techniques. Similarly, the qualitative data collection and analysis from both in-depth cases allows for reliability. However, in the case of Hospital XYZ's archival records analysis, reliability may have been compromised as it required specialized information systems integration skills, given the existence of highly fragmented systems. Nonetheless, extensive efforts were made to clearly outline in this thesis how said systems were integrated and how their data informed our analysis and subsequent findings.

5.3 Data Collection

Different data collection methods were used for each sample of hospitals as required by the research questions they were primarily meant to address.

5.3.1 Data collection of seven Massachusetts hospitals sample

In the sample of seven Massachusetts hospitals we administered our research instruments to the CEOs as these are "*in a position to be extremely knowledgeable about conditions in their particular industry*" (Lawrence and Lorsh 1967). Furthermore, CEOs are "*most likely to be key decision makers and to determine organizational policy*" (Aiken and Hage 1968). Notably, several scholars have also specifically targeted hospital CEOs in their studies of organizational strategy and organizational effectiveness (Ashmos, Duchon et al. 1996; Bazzoli, Shortell et al. 1999; Abernethy and Lillis 2001). Finally, others concluded that senior executive self-evaluations of overall organizational effectiveness are reliable, and go as far as saying that the dominant coalition of senior executives can adequately predict the future success or failure of their organizations (Reimann 1982).

All in all, CEOs were purposefully sampled as they would be closest to our phenomena of interest (i.e. *How is hospital enterprise performance currently measured?*) and would provide the richest information to help address our research question.

Scheduling of interviews was done via email and over the phone. All seven CEOs from the sampled hospitals were interviewed on-site and allowed for audio recording. Each interview lasted 120 minutes. The first 80 minutes were dedicated to administering the interview protocol, and the remaining 40 minutes were used for three quantitative questionnaires[60]. The interview protocol was sent to the subjects via email one week prior to the interview, thus each subject had an opportunity to review the protocol in advance and ask clarification questions. Publicly available information was gathered for each hospital so as to provide background information to the interview (e.g. news articles, hospital website, Medicare's hospital compare website). Additionally, several of the subjects voluntarily provided documentary evidence, to support their answers, including hospital brochures, mission statements, and in some cases strategic plans. The subjects weren't made aware of the quantitative questionnaires until the actual interview, and were assisted in filling them out as required.

Both the interview protocol and the quantitative questionnaires reflect literature insights both in terms of content and data collection method. Chapter 2's insights and deductions from the literature were used to devise the questions on the interview protocol, as well as populate the performance dimensions and performance metrics used in the quantitative questionnaires. Additionally, the quantitative questionnaires incorporate a pair-comparison technique as well as a simultaneous comparison technique and both assign relative weights to performance criteria (i.e. Chapter 2 performance dimensions) (Globerson 1985).

[60] For a copy please refer to Appendix II.

5.3.2 Data collection of Hospital XYZ and Hospital ABC

At Hospital XYZ and Hospital ABC data was collected from multiple stakeholder groups including and beyond senior leadership. As with the sample of seven Massachusetts hospitals, interviews were conducted with senior leaders so as to understand organizational strategy and organizational effectiveness. However, the in-depth case studies were designed to explore whether an enriched understanding of hospital enterprise architecture can improve hospital performance, and hence necessarily implied collecting data throughout each enterprise as well as probing senior leadership on additional themes. Several studies of hospital organization and/or effectiveness have adopted a similar approach (Longest 1974; Argote 1982; Gillies and Shortell 1993; Abernethy and Lillis 2001). Furthermore, this approach allowed for the research design to incorporate the previous recommendation of exploring organizational unit variation and interaction across adjacent levels of analysis (see section 5.2.4.1). Moreover, a core interest in this thesis is to approach hospitals as complex socio-technical systems and evaluate the extent to which lean enterprise principles are being followed by high performing hospitals (e.g. including relevant stakeholders; holistic understanding of operations; etc) and in turn describe their underlying enterprise architecture.

Table 5-4: Hospital XYZ and Hospital ABC data collection overview

Case Study	Interviews	Non-Participatory Meetings	Walkthroughs	Research Site Visits
Hospital XYZ	34	8	5	37
Hospital ABC	20	7	4	1 month onsite
Total	54	15	9	

All qualitative data collection described in Table 5-4 was conducted in person by the author. Data collection at Hospital XYZ took place in 2006 and throughout 2007, whereas at Hospital ABC it consisted of a one month long onsite visit in 2008 (i.e. Hospital ABC was located in the UK and hence less adequate for sporadic visits). At both sites the author underwent the necessary human resource training (e.g. videos on how to handle an emergency; how to be mindful of patients; etc) and medical exams (e.g. vaccinations, tuberculosis test, etc). At Hospital XYZ he was introduced to the organization via an internal memo circulated by senior leadership to the various

department heads, and wore a badge with the designation of "Research Assistant". At Hospital ABC he was integrated into the in-house lean department that reported directly to the Director of Strategy and was created by the CEO to conduct lean transformation projects throughout the hospital. He wore a badge with the designation of "Change Leader", had his own desk and telephone at the hospital, and was always introduced as a PhD student working on an independent research project.

The number of listed interviews in Table 5-4 pertains only to the interviews where an interview protocol was followed and audio recording was attempted (81% of interviewees consented audio recording). Qualitative data was collected in many other informal settings (e.g. over lunch at the cafeteria; at the after work pub; etc) as well as formal (e.g. meetings; walkthroughs; observation). In terms of walkthroughs, these were hosted by senior nurses who had been at their respective hospital for at least 10 years, and were knowledgeable of the various information systems (if available), key processes, people, etc, and hence hosted the walkthroughs at their specific service units as well as those with which they interacted most with. In terms of non-participatory meetings, these were day-to-day operational meetings where the author was introduced at the beginning of each meeting as a PhD student, and remained a silent observer throughout said meetings.

A total of 54 interviews were carried out with 43 individuals spanning multiple functions (e.g. senior leadership, administrative support services, and clinical support services) and multiple service units (e.g. emergency department, inpatient units, operating rooms) for a total of 60 hours of interviews. The distribution of the interviews by in-depth case study and respective stakeholder group is shown in Figure 5-5.

The strategies and procedures for selecting interview respondents, meetings, and walkthroughs were guided by the general principles of grounded theory research and in accordance with sanctioned practices for qualitative data collection (Glaser and Strauss 1967; Strauss and Corbin 1990). In line with grounded theory practices, data collection and analysis were done simultaneously, so as to allow for the selection of interview

respondents, as well as the inclusion of the most relevant questions to further explore and shape emerging phenomena of interest.

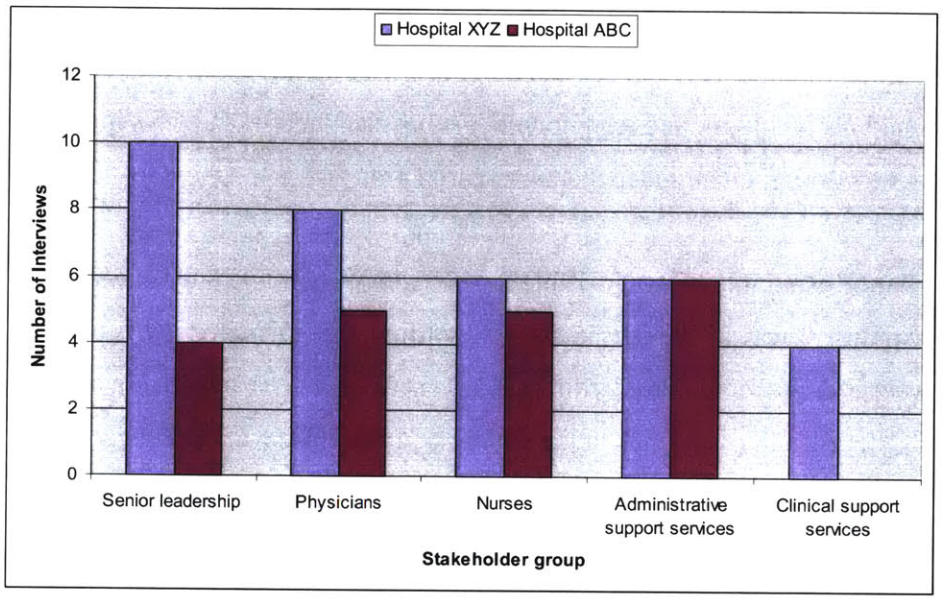

Figure 5-5: Interviews by Stakeholder Group per Hospital

For instance, as research progressed at Hospital XYZ, data collection efforts focused on inpatient service units that exhibited either worse or highest performance (i.e. polar cases recommended in section 5.2.4.1) in their interaction with the emergency department. Notably, data collection efforts at Hospital ABC benefited from the preliminary findings at Hospital XYZ, as we added precision to our targeting of relevant respondents, observation locations, meetings, etc. Additionally, data collection at Hospital ABC also benefited from the research participation of a Harvard Medical School (HMS) student doing a surgery rotation at Hospital ABC during the same period. By design, only the CEO of Hospital ABC was aware that the author and the medical student were collaborating on the research project, and hence additional valuable insights were obtained from Hospital ABC's physicians as collected by the HMS medical student. Specifically, the HMS student collected observational and internal document data pertaining to her interactions with different surgeons while assisting them on different patient procedures performed in different ORs. Furthermore, the HMS student logged her data daily (i.e. within 24 hours from phenomena occurring) so as to preserve its contents

and readily share them with the author, who then added it to his overall data collection and analysis.

Finally, additional types of data were collected either in person (e.g. direct access to a software system) or over email (e.g. excel sheets sent by process improvement engineers). The information architecture at Hospital XYZ included an electronic medical record system partially integrated with other systems, including the billing system, which allowed for a richer dataset to be collected. Conversely, at Hospital ABC, despite being a leader in the UK, all patient medical records were in paper format and all workflow heavily relied on paper, therefore its underlying infrastructure limited our ability to collect such quantitative data. Pertinently, health care scholars have noted that "*the cost of collecting data depends on each hospital's information capabilities, which vary among hospitals and over time at any given institution*" (Mehrotra, Lee et al. 2003).

Figure 5-6 provides an overview of the different types of evidence that were collected during each in-depth case study. With the benefit of full organizational access (and within the limits of the information architecture), evidence was collected on each of the performance dimensions defined in the context of our first two research questions. Additionally, four types of data are specified in terms of their source (i.e. archival, internal documents, public documents, subjective). Finally, a distinction is made in terms of unit of analysis for said data, namely hospital wide (i.e. aggregated metrics) and service unit level (e.g. emergency department; inpatient service unit).

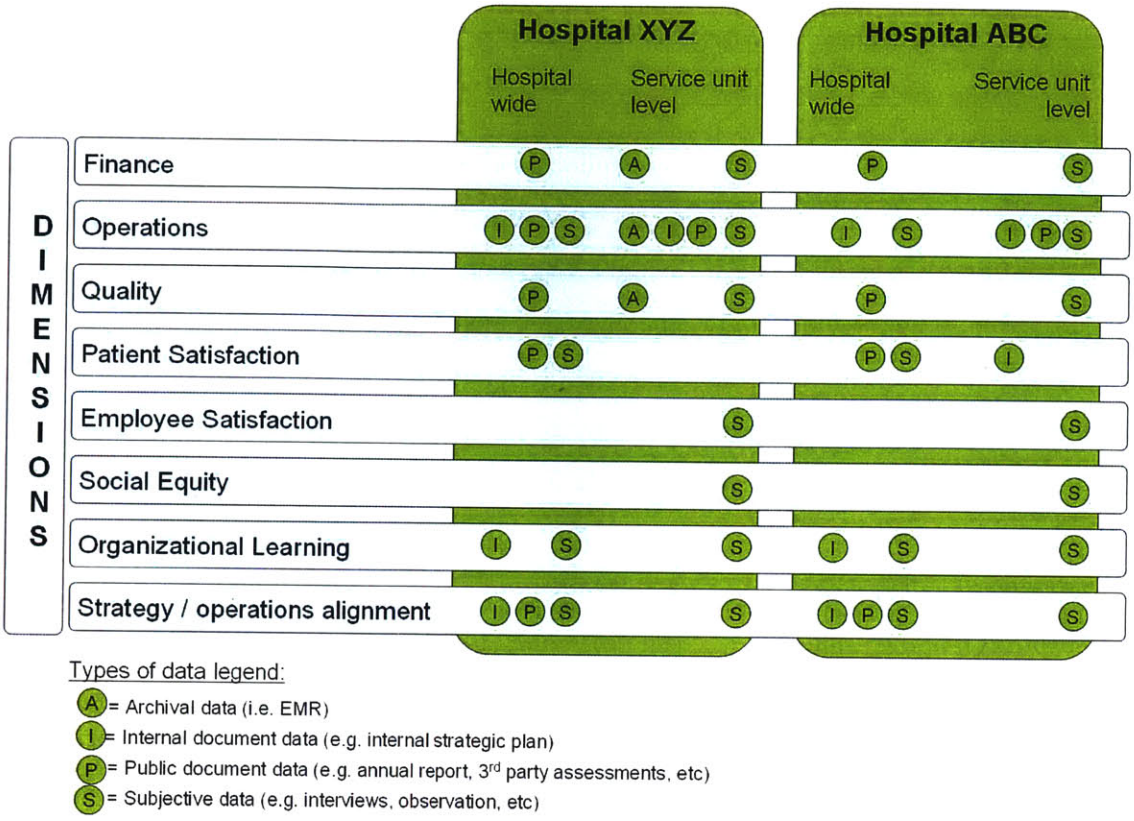

Figure 5-6: In-Depth Cases Data Evidence Overview

Data collection efforts ended when no new categories of insights were being generated from further research, which is known as *theoretical saturation* in grounded theory. Succinctly, "*theoretical saturation is simply the point at which incremental learning is minimal because the researchers are observing phenomena seen before*" (Eisenhardt 1989).

5.4 Data Analysis

Early in this chapter we noted that determining what constitutes a Lean Enterprise Architecture, or any theory of the business, may sound deceptively simple but it involves several years of empirical experimentation before reaching a clear, consistent, and valid theory for a given organization (Drucker 1994). Hence, given the nascent phase of development of enterprise architecture from a lean enterprise perspective (Nightingale

2009) a key motivation for this research was to empirically and theoretically enrich MIT's emerging Nightingale-Rhodes Enterprise Architecture Framework (NREAF).

As noted in section 5.1, this thesis is situated between enterprise architecture's nascent theoretical maturity and that of lean enterprise thinking intermediate theory. Therefore, our research study was primarily designed to be exploratory and inductive, but also was deductive in leveraging existing literature. For instance, our theoretical proposition that an enriched understanding of hospital enterprise architecture can improve hospital performance, emerged from the empirical data, was compared with the literature as well as across embedded units of analysis, and guided subsequent data collection and analysis. Several of the previous sections in this chapter already describe examples as to how literature and emergent phenomena of interest guided theoretical sampling, analysis, and eventually reached theoretical saturation.

In essence, the iteration between inductive theory development and deductive theory testing wasn't the product of a sequential progression (i.e. literature review -> research question -> data collection -> analysis -> publication) but rather a series of iterative and cyclical steps, that allowed for the methodological fit to be adjusted as new findings emerged from the data. Finally, it is important to emphasize that our research design and associated data collection and analysis methods, neither exclusively followed grounded theory's traditional practices (Glaser and Strauss 1967) nor those of case study research (Yin 1994), but rather a blend that leveraged the best of each (Eisenhardt 1989; Edmondson and McManus 2007).

51 of the 61 interviewees allowed for audio recording (i.e. considering both in-depth case studies and the seven Massachusetts hospitals) which were recorded and transcribed by the author. During the remaining 10 interviews, notes were taken by hand during the interview, as well as immediately after the interview, and then transferred to electronic format within 24 hours. In the case of Hospital ABC audio recordings were transcribed within 24 hours and analyzed with grounded theory cording methods. The interviews of Hospital XYZ and those of the seven Massachusetts hospitals were revisited, transcribed

and coded. Such reflects the need for alternative analysis methods that were acquired when Hospital ABC revealed significant deficiencies in terms of its information architecture, and prompted the use of grounded theory analysis methods on interview transcripts, and other qualitative data (e.g. operations observations, non-participatory meetings). Having acquired the expertise in such rigorous qualitative analysis methods the decision was made to revisit the previous datasets and apply the same rigor. Moreover, as scholars have noted, grounded theory is "*a practice learned largely through apprenticeship*" (Charmaz 1983), and to that effect the author participated in two doctoral seminars on field research methods, in 2006 and 2008, from Sloan and Harvard Business School, and gradually learned throughout the research. Notably, this decision was also aligned with the research design of exploring the interrelatedness of this thesis' research questions, and further strengthens the findings pertaining to each one of them.

Coding of qualitative data constitutes the initial phase of the analysis and comprises what is termed the *categorizing* and *sorting* of the data. Such codes are shorthand devices that allow the researcher to label, separate, compile, and organize qualitative data. Whereas some scholars promote the use of completely free-coding unconstrained by prior theory other scholars advocate the strict use of codes based on existing theoretical constructs. Yet another approach, and indeed followed in this thesis, is that of Miles and Huberman (1994) who argue that when theory guides inquiry, it is more efficient and realistic to begin with a conceptual framework, and gradually modify, eliminate, or add codes as these emerge from the data. In essence, the approach leverages theoretical guidance and allows for empirical flexibility (or theory revision) (Malina and Selto 2001).

A more granular explanation of coding is one that describes the difference of *initial* coding and *focused* coding. Initial coding precedes focused coding and allows the researcher to interpret and discover the data. Codes may pertain to contextual factors and role descriptions, or more subtle matters such as what stakeholders ignore, are unaware of, or place particular emphasis on. Focused coding uses a limited set of the codes that were developed during initial coding, and then applies them to large amounts of data. Gradually, focused codes can merge with other codes, or be replaced by more relevant

codes, or finally become part of a category. Notably the use of the literature may help identify a construct that adequately characterizes phenomena of interest, or offers an alternative interpretation, but in either case helps the researcher further define and probe the data. An example would be a senior nurse from an inpatient service unit attempting to describe a process from the emergency department (ED), and wholeheartedly believing that what he or she is saying is correct, and yet it is a very inaccurate description of the process as verified by observation, internal documents, and ED interviews. Similarly, senior leadership may describe a given service unit as a low performer and not contributing to the hospital mission, and yet quantitative data determines otherwise, which prompts the question as to why senior leadership said at first what it did. Was it due to a lack of information and honest misrepresentation, or was it something else? Moreover, what factors could be at play that were inducing such behavior and how did the underlying enterprise architecture mitigate/exacerbate said behavior? Also, when comparing the behaviors of senior leadership with those of the senior nurse (and other stakeholders) what are the similarities and differences?

Addressing each of these questions with qualitative evidence (as well as quantitative), together with the literature, allows for the next step, namely the writing of *memos*. Memos centralize evidence that has been interpreted and related to observed (and/or measured) phenomena. The writing of a memo may prompt revisiting of a category, or underlying focused coding and hence further refinement of a code, or other memos. Next memos are *sorted* and then *integrated* which increases analytic precision over categories that are insufficiently defined. Also, the integration of memos allows the researcher to identify relationships that might have remained elusive until then. Notably, sharing the resulting integrated memos, or rather, describing them to members of the organization, is a useful way of validating and further refining findings.

The process of coding, categorizing, writing memos, sorting, and integrating, gradually allows the researcher to progress towards more abstract analytic levels (Ghauri 2004). Finally one eventually reaches theoretical saturation in the presence of emergent data, of both qualitative and quantitative nature, as well as the literature. A key potential pitfall to

be aware of is the use of categories that are too small and too numerous, as it gives rise to an analytic landscape that is hard to manage, and potentially further obscures phenomena of interest (Yin 1981). An analogy in systems thinking would be that of merely focusing on the interactions between nurses and physicians inside a single service unit, or studying a single service unit's patient flow and associated processes to its utmost detail. Moreover, such an analytic approach would contradict the very lean enterprise principles that we are wanting to study in the context of hospital enterprises.

Although coding efforts first began on paper, and then progressed to Microsoft Excel sheets, they ultimately evolved to the use of a specialized tool for qualitative data analysis, namely MAXQDA10[61]. The use of said software allowed for a manageable, searchable, and visual theory building exercise. Notably some of the features of the software were disregarded (e.g. some stakeholders referred to the emergency department as "ER", others as "ED", "emergency care", etc, which rendered lexical frequency counts useless). Also, as evidenced throughout this thesis, leveraging of multidisciplinary literature was a key component of the research strategy, and perhaps in an innovative way, MAXQDA10 was used to code each and every single article or book referenced in this thesis. Theoretical saturation was obtained within the literature itself and several times doing so beyond an individual body of knowledge. Furthermore, the above mentioned process that gradually moves towards more abstract analytic levels, was also applied to the literature, hence further strengthening our findings. In total over 8000 coding instances were recorded in MAXQDA10.

Finally, descriptive statistics were derived from the three questionnaires collected from the seven Massachusetts hospital senior leaders, identifying which performance dimensions as well as metrics are the most and least prevalent. Also, as previously noted Hospital XYZ's information architecture allowed for a richer dataset comprising one year's worth of inpatient discharge data (totaling 24,200 patient discharges), including several properties of interest (e.g. length of stay, diagnostic related group, acuity level, arrival date, discharge date, origin, etc). Notably, an additional dataset at Hospital XYZ

[61] MAXQDA is short for Maximum Qualitative Data Analysis (www.maxqda.com)

was made possible through the integration of disparate information systems, and enabled the quantitative analysis of throughput for each key process within the emergency department, as well as interacting inpatient service units. The resulting datasets were analyzed using descriptive statistics, regression analysis, and extensive use of data manipulation SQL queries with graphic visualization. Quantitative data analysis was often guided by emergent phenomena of interest (e.g. What is the financial contribution of the emergency department? Does the quantitative data validate anecdotal evidence that inpatient service unit X is fastest in its interaction with the ED? Etc). Finally, results were summarized in graphical format so as to visually identify trends in the data, facilitate the triangulation with other analysis, and also convey emerging findings to hospital stakeholders.

6. Seven Massachusetts Hospitals

Our initial exploratory research at a leading US hospital yielded that despite the hospital's favorable external ranking, there were system dysfunctionalities that were neither captured by the metrics of the external entities nor by those of the hospital itself. To that effect, the literature reviews in chapters 2 and 4 were conducted to build our understanding of hospital enterprise performance measurement, and hospital environments and operations in general, so as to inform our research. Specifically, the longitudinal analysis on the hospital performance measurement literature identified a trend in that the number of performance dimensions considered in published articles increased over time, following the maturation of the performance management literature that recognized the need for multidimensional performance measurement. However, the literature review also characterized an inverse relationship between the number of performance dimensions considered and the inclusion of empirical data in the studies (i.e. beyond a conceptual contribution on how to measure hospital performance). Moreover, as the number of performance dimensions included in the studies increased, the inclusion of data in such studies decreased. Furthermore, while informed by lean enterprise principles we defined a total of eight performance dimensions to assess hospital performance measurement, namely customer satisfaction, employee satisfaction, finance, operations, organizational learning, quality, social equity, strategy/operations alignment. In analyzing the literature through our eight dimensions we found that hospital operations was the one most often used, followed by finance, and quality of care, while the remaining dimensions had little or no expression.

Ultimately given the sparse empirical evidence as to what extent hospitals are adopting a multidimensional perspective of performance, this chapter presents findings concerning our first research question: *How is hospital enterprise performance currently measured?* Furthermore, the chapter also addresses the follow-on research question: *How could hospital enterprise performance measurement be improved using lean enterprise principles?* As described in Chapter 5, these research questions were addressed with the

exploratory and inductive study of seven Massachusetts hospitals that were theoretically sampled according to a literature informed hospital typology (see Table 6-1), which also informed the qualitative and quantitative research instruments administered to the hospital CEOs.

Table 6-1: Seven Massachusetts hospitals sample

Hospital Bed Size	**System Affiliation**		**No System Affiliation**	
	teaching	no teaching	teaching	no teaching
Small Hospital (<= 99 beds)		Hospital D		Hospital A
Medium Hospital (100 to 399 beds)	Hospital F	Hospital E	Hospital C	Hospital B
Large Hospital (400+ beds)	Hospital G			

In line with case study research guidelines (Yin 1994) this chapter organizes our findings in terms of key themes which characterize similarities and distinctions resulting from the qualitative and quantitative hospital analysis. Furthermore, our findings are compared and contrasted with the literature. Finally, we elaborate on how lean enterprise principles can improve hospital enterprise performance measurement and, in doing so, hospitals are more likely to progress towards becoming lean hospital enterprises.

6.1 Overview of MA Hospital Environment

In describing their external environment and health care industry in general, all seven hospitals were consistent in characterizing it as low financial margin, fast moving, and highly prone to value misalignments induced by external entities such as payers and regulators. Furthermore, several references were made describing the heterogeneity of hospitals, beyond typological considerations, and how it in turn affected hospital competition and attempts at conducting performance comparisons.

All of the senior leaders described financial viability as one of their key responsibilities, and that in Massachusetts those hospitals performing *in the black* had thin operating margins from 1% to 3%. The highest financially performing hospital in Massachusetts (as

measured by its operating margin) shared that the US economic recession was posing significant challenges that it felt were beyond its control, as these pertained specifically to losses incurred from the financial system at large (i.e. debt bonds).

The evolution of medical science has made possible CAT scanners which weren't available 20 years ago, and today even the smallest of hospitals have this technology. Patients that used to require a hospital admission, no longer do so, and are treated instead in outpatient settings. So much so, that even the most advanced hospitals were concerned with the technology commoditization trend where referring physicians, insurance companies, and eventually patients themselves, pressured them into lower bids for simple lab tests today, and perhaps complex procedures (e.g. bypass) tomorrow. However, the evolution in medical science has impacted hospitals beyond care provision alone, as evidenced in billing related observations. The underlying complexity of charge capture while treating patients is such, that ideally hospitals have in place the necessary information systems to manage said data and populate insurance claims data. Additionally, although hospitals invest considerably in billing related human resources and technology, they reported that they still incur expenses that go unaccounted for.

As for payers, both commercial and governmental, these were generally held accountable for the major value misalignments in the health care system. Hospitals' relationship with commercial payers was described as mostly adversarial, and contributing to the high administrative costs that currently exist within hospitals.

Table 6-2: Evidence of hospital adversarial relationships with payers

Hospital	Interview quote(s)
F	"[Stakeholder] misalignments generally don't occur because of inside forces. They generally occur because of outside forces.[...] Cuts to reimbursements create challenges [which] if not managed well the employees become...things become unstable, the employees become restless, the physicians become restless, so anything to do with financials usually throws a monkey wrench into the alignment."
C	"Let's start with the payers. They are awful. They are impossible. They bully us. They have tremendous leverage that we don't have. [...]They create an incredible administrative burden for us. They talk about their 15% of

	administrative cost of health insurance, but they don't factor in what our administrative cost is to deal with their administrative regulations, which are 30% in our end. We find them very difficult to deal with because of the imbalance in power."

Several of the hospitals felt that they were at a disadvantage in their negotiation relationship with insurance companies, and commonly referred to the example of a prominent health care partnership in Massachusetts (i.e. Partners HealthCare) which was able to negotiate considerably better contracts with insurance companies because of the combined clout of its hospital members (e.g. Massachusetts General Hospital and Brigham and Women's Hospital). Such negotiation clout is well depicted in a report issued by the Massachusetts Attorney General: *"Price variations are correlated to market leverage as measured by the relative market position of the hospital or provider group compared with other hospitals or provider groups within a geographic region or within a group of academic medical centers"*(Coakley 2010).

From a related perspective, the smaller hospitals coincided in their concern towards referring patients to larger hospitals as these tended to refer them back to different lower acuity providers with whom they shared more beneficial contractual relationships. Essentially, in seeking specialist care for their patients, smaller hospitals are faced with the prospect of no longer being able to care for such patients in the future.

Yet another impact of payer entities is that they require hospitals to measure and report their performance on specific process based measures, which ultimately are meant to represent the quality of care being provided. Stroke was a common diagnose example referred to by the interviewees, where the hospital measures whether an aspirin was administered within a given time frame, and whether the patient underwent a CAT scan exam. In essence, quality of care is mostly managed at a process level as these are easier to track than measuring a quality outcome that may only express itself at a later point in time.

Looking forward, CEOs converged in their concern towards the atmosphere of payment reform and how it is going to affect their individual operations in Massachusetts.

Table 6-3: Evidence of payment reform concern

Hospital	Interview quote(s)
A	"I tried to read as much of the Federal health care reform proposals as I could, not the 2500 staked pages, but the bullets so that we could see where we would going to be focusing our attention."
B	"We have a chaotic financial environment. For any hospital to try to project right now what Medicare is going to pay, private insurers is going to pay, Medicaid is going to pay, beyond the current year we are in and maybe next year, they are just making it up. Because until the federal government figures out what it is doing, health reform or no health reform, and even though most of it doesn't kick in for later years, you have got to know if there is a reform or not. Until the commonwealth of Massachusetts figures out what the hell it is doing. Even for this hospital between Medicare and Medicaid, you know it just close to 50%, you know, when you have a chaotic environment out there, you can't forecast dollars three years out."
C	"The other driver is global payments, capitation, if we get to that, and we will eventually, we need a very, very robust network of primary care doctors."
F	"Right now we have to figure it out because the way that the world is going with the continual cutting of rates, and continual ratcheting back based on cost of the commercial payers, and I am sure that Medicare is going to reduce their reimbursement as well..."

Upon considering how they would respond to the impending health care reform, senior hospital leaders expressed concern towards the existing shortage of primary care physicians. Indeed, some of the hospitals were already experimenting with some forms of capitation and expressed difficulty in being able to recruit more primary care physicians. Hospital leaders offered that it was a reflection of payment incentives, as recent medical school graduates were selecting higher paying specialties[62] (see Figure 6-1). Notably, primary care physicians are essential in a global payment environment where hospitals are rewarded a fixed fee per month per patient regardless of any expenses incurred, and to that effect, hospitals have the incentive of keeping patients healthy and administering preventive care.

[62] A targeted literature review search confirmed that an association exists between physician salary and residency fill rate in the US. Rising student debt was offered as an explanation to the observed behavior (e.g. a Harvard Medical School education typically costs $300K which is in addition to any debt related to a graduate's pre-med education, thus commonly totaling $500K in student debt).

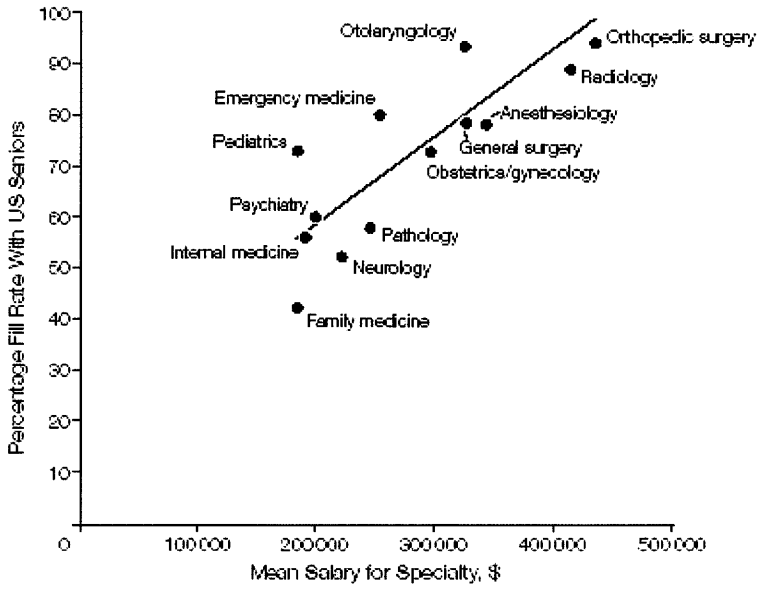

Figure 6-1: US Medical Residency Position Fills vs Mean Overall Income by Specialty (from (Ebell 2008))

As for the regulatory environment, several observations were made concerning its impact on Massachusetts hospitals. Examples included the amount of documentation required in order to remain accredited by The Joint Commission and eligible for Medicare reimbursements. Other examples were process specific such as keeping inefficient processes (e.g. 24 hour staff member in a given service unit regardless of patient volume), hiring a chief nursing officer, or answering hospital complaints within a week. Mid-size and smaller hospitals went as far as saying that unless something is a regulatory requirement, they wouldn't consider expending resources to implement and maintain an initiative.

> *"Unless it is required by regulations we aren't going to know about it because we don't have to know about it. We are not truly a learning organization, which frankly I would love to be, but I am just trying to keep my head above the water."*
>
> Hospital A CEO

Additional consideration was given to the issue of physician shortage and associated in turn to a nationwide regulatory requirement that had come into effect in 1996. Some of

the leaders attributed their difficulty in managing contractual relationships with physician groups that operate in their facilities to the shortage of physicians (across medical and surgical specialties) that results from the capping of available medical residencies[63].

> *"So I think the docs have been extremely difficult to manage, and it is a supply and demand issue ever since the Pew commission in 96 capped the number of residencies there aren't enough docs to go around so they are naming their tune. [...]So it is a downward spiral for community hospitals... "*
>
> Hospital E CEO

Finally, several hospital leaders described the heterogeneity of hospitals, beyond typological considerations, and how it in turn affected hospital competition and performance comparisons (see sample in Table 6-4). To begin with, hospitals configure their departments differently (e.g. dedicated vs shared resources) and even use different definitions in characterizing their inpatient and outpatient services, thus compromising market share calculations. Similarly, hospitals differ in their definition of common metrics (e.g. patient falls) and also in their behavior in reporting them (i.e. sentinel events are tracked with voluntarily reported data and not everyone reports the data). Additionally, hospitals vary in their organizational arrangements with physicians and employees at large. Some of these are salaried, and may or not be unionized, while others are part of independent organizations. Furthermore, different hospitals offer different services. The smaller hospitals tend to offer less specialized care due to resources constraints, while some of the larger hospitals strategically elect not to offer certain services (e.g. pediatrics, obstetrics). Similarly, some hospitals offer more routine care, while others in offering their specialized care, attract sicker patients, and the existing case-mix adjusters are thought to be insufficient to properly reflect the different patient populations (and hence the costs incurred by hospitals in caring for them). Lastly, and as

[63] A targeted literature review search confirmed that a health commission recommended that US medical classes substantially reduce their size (i.e. 20% to 25%) and the number of residencies. Pew Health Professions, C. (1995). Critical challenges : revitalizing the health professions for the twenty-first century : the third report of the Pew Health Professions Commission. San Francisco, Calif., UCSF Center for the Health Professions.

mentioned previously, different hospitals are able to negotiate different contracts with insurance companies and are paid differently for the same services.

Table 6-4: Evidence of hospital heterogeneity beyond typological considerations

Hospital	Interview quote(s)
B	"I have no idea what rates are being charged. I know what I pay for my employees but I have no idea what everybody else pays. And I have contracts with insurance companies as a provider. I don't set the prices for insurance contracts."
D	"Well inpatient market share now is so messed up because some people are very aggressive about calling things observation and some aren't, and it is hard to tell what your real market share is"
E	"You know [patient] falls are even defined differently from hospital to hospital. If you are holding the patient when they fall, is that a fall? Some people call it a fall and some people don't. Medication errors you know until you get physician order entry in place, you know, medication errors are self reported, and there is different levels of self reporting by hospital. It is very hard to get good benchmarking in a series of cottage industries."
F	"It is very hard to benchmark in hospitals because the departments from hospital to hospital are configured differently"

All in all, our overview of the Massachusetts Hospital environment as described by the studied seven hospitals is largely consistent with our literature review.

6.2 Comparing Hospital Missions and Strategic Visioning

In assessing what businesses in general could learn from best performing non-profit organizations, Drucker observed that they "*devote a great deal of thought to defining their organization's mission. They avoid sweeping statements full of good intentions and focus, instead, on objectives that have clear-cut implications for the work their members perform*" (1989). Drucker also observed that said missions began with an external focus in the surrounding community and the "customers" to be, rather than internally with organization or financial related matters. Ultimately, he observed that starting with an organization's mission is the first and foremost lesson that businesses can learn from successful non-profits.

What follows is an analysis of the missions of the seven hospitals included in the sample. Notably, the data analyzed pertains purposefully to the qualitative answer provided by the hospital CEOs (see Table 6-5)[64]. Overall, eight core hospital mission elements emerged from the data, whereby four of them were consistently featured in the majority of the sample.

Table 6-5: Hospital mission elements

	Hospital Mission Elements							
Hospital	Care for any patient (local or otherwise)	Support the surrounding community	Deliver broad array of services	Deliver optimum care and remain viable	Deliver excellent specialized care	Deliver excellent team based care	Teaching medicine and health professionals	Excellent medical research
A	x	x		x				
B	x	x	x	x				
C	x		x	x	x	x		
D	x	x		x				
E	x	x	x	x				
F	x	x	x	x	x		x	
G	x		x	x	x		x	x

By inspection all seven leaders feel responsible for any patient that seeks care at their facility regardless of ability to pay, residence location, ethnicity, etc[65]. Similarly almost all of the respondents reflected a specific concern towards meeting the expectations and supporting their surrounding community. Hospitals C and G didn't make a specific reference to their surrounding community, and instead mentioned a regional, national, and international orientation. In the case of Hospital G, the CEO referred to the public in general, and most likely so, given that the hospital is in the center of Boston and

[64] An analysis of internal hospital documentation (e.g. Strategic Plan) and/or hospital websites (e.g. Mission Statement) supported the CEOs answers and didn't introduce new hospital mission elements. However, some of the hospitals had written documentation that went beyond the CEOs answers. The interview protocol included multiple questions which broached the same topic, and hence gave respondents the opportunity of providing a more accurate answer that reflected their perspective and concerns as CEOs of their organization (i.e. findings emerged from multiple questions answered by each respondent).

[65] Such is in line with the regulatory requirement previously identified in Chapter 4, namely the Emergency Medical Treatment and Labor Act (1986).

surrounded by other healthcare providers of similar stature. Hospital C is a tertiary care hospital with two community hospitals close by, which might have explained why its leader didn't refer to the surrounding community specifically.

Related to the provision of care to the surrounding community is the delivery of a broad array of services so that the community has ready and convenient access to care. As many as five of the seven hospitals, included the breadth of services in their hospital mission description. The two hospitals that didn't do so, namely Hospitals A and D, are small hospitals (see Table 6-1) and specifically see themselves as supporting remotely located communities needing primary care services or basic internal medicine inpatient care, which are then transferred to other hospitals if need be.

Interestingly, all respondents also included as part of their mission the requirement to deliver optimum care whilst remaining viable organizations. In doing so, hospital leaders made the distinction between delivering the care that their surrounding community wants, versus the care that they need, which ultimately is what is considered when planning and maintaining services. Furthermore, some of the hospital leaders specifically referred to requiring their technology enthusiastic physicians present them with procedural volume projections whenever they sought hospital investment to implement said technologies. As such, hospital viability was managed both internally and externally. Such is in line with the responsibility that senior leaders alluded to when describing their hospital environment, and may partly explain why they have been part of the select few that have maintained financial viability and consistently remained *in the black* in Massachusetts.

The remaining four hospital mission elements were more idiosyncratic and reflected typological characteristics in the sample. For instance, Hospitals C, F, and G, are registered as major teaching hospitals and hence have a concern towards delivering excellent specialized care. Interestingly, although Hospitals F and G specifically included teaching in their mission descriptions, Hospital C admitted that teaching wasn't one of its core focuses. However, Hospital C distinguished itself by emphasizing its core value and culture of delivering excellent team based care whereby patients with multiple illnesses

can be treated efficiently and effectively. Finally, Hospital G, the largest hospital in the sample, described what is often referred as the triple mission, namely, patient care, teaching, and research. Notably, both Hospital C and F mentioned at times an interest towards research, but such interest accrued specifically from individual physician leaders in specific specialties, rather than representing an overall hospital mission element.

Next we examined the strategic visioning for each of the seven hospitals included in the sample and we found corroborating evidence of the hospital missions as well as specific strategic considerations for each hospital (see Table 6-6).

Table 6-6: Evidence of hospital strategic visioning

Hospital	Interview quote(s)
A	"we want to be the healthcare provider for our 9 towns, we serve nine towns here in Massachusetts predominantly" "We do the basic things very very well" "Historically, we went at it alone [but now we want to]approach and develop an affiliation with a larger system"
B	"We are a community hospital and we are here to continue to meet the healthcare needs of the residents of our service area."
C	"The strategic vision is dependent upon growth. It is dependent upon expansion of our current excellence. It also depends upon improving teaching and research. But probably the real focus is growth and excellence."
D	"it doesn't mean that we want our picture on the cover of modern healthcare. It means that we score well against benchmarks for similar institutions or services" "really be a viable resource for this community into the future. That is a challenge for a small community hospital these days"
E	"maintain the health and healthcare of our inhabitants, while maintaining the economic sustainability of the [hospital E]"
F	"To really benefit the patient, the family, and the communities we serve by achieving benchmark levels of performance in quality and safety, clinical metrics, and financial metrics." "We also strongly believe that employee and physician satisfaction are strategic imperatives, that enabling the workforce and creating a culture that is positive for physicians and the employees results in tremendous payback in terms of patient satisfaction" "ties in with financial is the strategy of creating a network where the hospital's bricks and mortar become the center of care, but that there are many spokes, a hub and spoke approach to business development"
G	"[our vision is to] do all [our mission] very very well and in particular with regard to clinical care, set a standard of care that encompasses the elimination of harm to patients and that provides excellent patient experience."

Hospitals A, B, D, E, and F, described their strategic vision as continuing to support and care for their surrounding communities. Both Hospitals A and D, the smallest hospitals in the sample, described difficulties accruing from their smaller size and that a system affiliation was a requirement in order to continue viable. Specifically, Hospital D had recently successfully negotiated its inclusion in a hospital system, whereas Hospital A was actively pursuing a system affiliation. Notably, although only Hospital F specifically mentioned enabling a satisfied workforce as part of its strategic visioning, several of the other hospitals provided evidence of a similar leadership prerogative[66].

Finally, having analyzed the hospitals' missions and strategic visioning, we specifically probed senior leaders for whom they considered to be their key stakeholders (see Table 6-7). In the words of one of the respondents:

> *"I think it would be easier to say who aren't your stakeholders."*
>
> Hospital D CEO

Table 6-7: Hospital key stakeholders

	Hospital Key Stakeholders								
Hospital	Community	Patients/ Families	Board of Trustees	Physicians/ Surgeons	Regulators	Employees	Payers	Referring Physicians	Donors
A	x	x	x	x	x	x	x		
B	x	x	x	x	x	x	x		
C		x	x	x	x	x	x	x	x
D	x	x	x	x	x	x	x		
E	x	x	x	x	x	x	x		
F	x	x	x	x	x	x	x	x	x
G		x	x	x	x	x	x	x	x

According to Table 6-7 senior hospital leaders share a multiple constituency view of their enterprise, and are concerned almost entirely with the same set of key stakeholders, which speaks further to the comparability of the hospital enterprise environment, at least

[66] Please refer to section 6.4.

from the perspective of senior leadership. Interestingly, all respondents regarded "physicians and surgeons" as independent from "employees" (e.g. nurses, supply technicians, etc) even when salaried models were in place (i.e. every care provider was in the hospital's payroll). Also, although there were few distinctions amongst the key stakeholders referenced, it is important to briefly elaborate upon them. First, Hospitals C and G were consistent in not mentioning the surrounding community as a key stakeholder (i.e. unlike the remaining hospitals, they didn't include serving the surrounding community as a core mission element). Also, Hospital C didn't refer to patients at large but rather *inpatients* specifically (i.e. patients admitted to the hospital). Then, Hospitals C, F, and G, which are medium and large hospitals that regard the delivery of excellent specialized care as a core mission element, emphasized a concern towards physicians that referred patients to them, as well as for donors and philanthropic activities in general.

All in all, we determined that despite the heterogeneity commonly described in the literature, and indeed in previous sections and chapters of this thesis, leading hospitals in Massachusetts share several mission organizational elements, as well as a concern towards a similar set of key stakeholders. Notably, such insight is particularly important when considering two lean enterprise principles, namely the identification of relevant stakeholders (i.e. Principle 2) and to some extent the consideration of hospital enterprise interdependencies (i.e. Principle 4). Finally, unlike the characterization prevalent in the healthcare literature (see Chapter 2), our analysis began uncovering senior leaders' consideration towards performance as a multidimensional construct (e.g. offering patients as broad as services as possible whilst remaining financially viable). Additionally, we captured initial evidence that senior leaders had as an objective to become and/or remain amongst the highest ranked hospitals in external benchmarks conducted by third party organizations (e.g. US Department of Health & Human Services)(HHS 2011). Having characterized the Massachusetts hospital environment, as well as the missions and strategic visioning of each of the seven hospitals included in the sample, we proceeded to probe further into their hospital enterprise performance measurement construct.

6.3 Hospital Internal and External Performance Measurement Practices

During the interviews participants were asked specific questions concerning their definition of hospital enterprise performance, what it meant to perform, and how said performance was measured. Furthermore, participants filed out three quantitative questionnaires probing specifically on performance dimensions and their relative importance to each other. The responses to these research instruments gave further insight into whether hospital CEOs had a lean enterprise perspective and whether they were indeed adopting lean enterprise principles in their measurement of hospital performance. What follows is a description of key themes that emerged consistently from the data both across the hospital sample and across research instruments.

6.3.1 Hospital multidimensional appreciation of performance

In describing their multiple constituency view of their enterprise, senior hospital leaders highlighted the multidimensional nature of the hospital performance construct. To begin with, different stakeholders may have different values expected from the hospital enterprise and hence enterprise value misalignment may exist. For instance, non-salaried hospitals commonly referred to Medicare's payments inducing tension between hospitals and physicians, in that physicians are paid on a per-diem rate, whereas hospitals are paid a flat rate. Moreover, physicians don't have an incentive to discharge patients sooner, whereas hospitals do. Similarly, physicians may have incentives to conduct specific types of surgeries where the hospital doesn't make money. Additionally, although patient expectations were considered important, senior leaders also noted that some of them look at things "from a keyhole" and satisfying their views could compromise the hospital as a whole. Ultimately, in an unprompted fashion interviewees consistently enumerated several performance dimensions which they tried to manage concurrently (see Table 6-8).

Table 6-8: Hospital performance dimensions (unprompted responses[67])

Hospital	Performance Dimensions					
	Quality	Financial	Patient Satisfaction	Operations	Employee Satisfaction	Education
A	x	x	x			
B	x	x	x	x		
C	x	x	x	x		
D	x	x	x	x	x	
E	x	x	x	x	x	
F	x	x	x	x	x	
G	x	x	x	x	x	x

Clearly, senior hospital leaders had a multidimensional appreciation of hospital performance. All seven hospitals enumerated quality, finance, and patient satisfaction. All of the non-system affiliated hospitals (i.e. A, B, C) didn't enumerate employee satisfaction as a core dimension. Finally, Hospital A was the only one not to mention operations, whereas Hospital G was the only one to mention education (which is in line with its previously identified distinctive interest in training medical professionals and research).

When defining what high performance meant respondents were consistent in emphasizing the importance of scoring well in multiple, if not all the performance dimensions they enumerated. Three respondents offered insight that particularly captures this characteristic, as follows:

> *"Patient satisfaction I put it rung down just because we could do terrible clinical care but if we are nice to the person they might rate us highly."*
>
> Hospital D CEO

> *"Again poor performance, I think, throws a monkey wrench into the alignment, if the institution isn't doing well, on a number of categories, whether it is patient satisfaction,*

[67] By unprompted we mean that respondents were openly asked about the performance dimensions they consider when measuring their hospital performance, and we purposefully didn't prompt them on the use of specific dimensions. Prompting was designed to only take place during the quantitative questionnaires, so as not to bias the qualitative responses.

or letting the facilities not get the attention they need, or not being able to give raises, or all those kinds of things, will create a misalignment."

Hospital F CEO

"if we have very high income and very poor patient care, we are not succeeding. What would constitute high performance is doing well on all of the dimensions. I can't think of one dimension that if it were well that we as a hospital would have higher performance. All the dimensions that I mentioned are required to be high if I am to have high hospital performance"

Hospital G CEO

In Chapter 2 we determined that the majority of influential articles which studied hospital performance only included one or two dimensions in their data analysis. Furthermore, we asserted that as the number of performance dimensions included in the studies increased over time, the inclusion of data in such studies decreased. Evidently, the senior leaders of the hospital sample in this research reveal a multidimensional appreciation of performance which isn't captured and/or followed in the current literature.

6.3.2 Hospital multidimensional assessment of performance

Having determined that respondents had a multidimensional appreciation of performance, and indeed strived towards attaining high performance on multiple dimensions simultaneously, we next probed respondents with quantitative instruments that prompted them on the relative importance of the performance dimensions given existing practices in their respective hospital. For instance, a respondent might have an appreciation for a performance dimension which (s)he deems important, however, its hospital performance measurement system (e.g. dashboard) has little or no representation of it, and hence it scores lower against the better represented dimensions[68]. Additionally, in the case of performance dimensions that were indeed similarly tracked in a given hospital, the respondents were asked to assess their relative importance to each other (e.g. generally,

[68] Each hospital provided internal documents as additional evidence of their hospital performance measurement practices. Such documents were a combination of Strategic Plans, Operational Plans, Board of Trustees Meeting Minutes, Dashboard printouts, etc.

the finance and quality dimensions had a considerable list of metrics being tracked at each hospital, but senior leaders placed different relevance on each of them).

Table 6-9 summarizes the data analysis performed on the quantitative instruments and compares it to the literature review analysis from Chapter 2. As explained in Chapter 5, two data collection techniques were used to capture the relative importance assigned to performance dimensions, namely the pair-wise comparison (i.e. distribute 100% across each dimension pair, 28 pairs in total) and the simultaneous comparison (i.e. distribute 100% across all eight dimensions).

Table 6-9: Hospital performance dimension prioritization[69]

	Seven Massachusetts Hospitals				**Chapter 2 Literature review**	
	Pair-wise comparison		Simultaneous comparison			
Performance dimension	Average	Rank	Average	Rank	Average	Rank
Customer satisfaction	11.70%	5	13.50%	3	10.62%	4
Employee satisfaction	9.82%	6	8.33%	6	8.85%	5
Finance	15.74%	2	19.67%	2	22.12%	2
Operations	14.52%	3	12.58%	4	23.89%	1
Organizational learning	9.23%	7	7.17%	7	3.54%	7
Quality	17.02%	1	24.33%	1	21.24%	3
Social equity	8.63%	8	4.33%	8	6.19%	6
Strategy / operations alignment	13.33%	4	10.08%	5	3.54%	7

The data show that respondents assigned similar relevance to each performance dimension in both quantitative comparison techniques. However, the simultaneous technique had the strongest discriminating power (i.e. highest scores scored higher and lowest scores scored lower) which is consistent with the observations of the methodological literature (Globerson 1985).

Overall the respondent data is consistent with the healthcare literature insofar as the designation of the top three dimensions (i.e. Operations, Finance, and Quality) and two of

[69] Rank was calculated in terms of the relative importance assigned to each performance dimension (i.e. highest percentage was ranked as 1, whereas lowest percentage was ranked as 8). In the case of a tie both dimensions were awarded the same rank.

the lower ranking dimensions (i.e. Organizational Learning and Social Equity). However, a closer examination reveals key departures from the literature. First, the senior leaders of the hospital sample unanimously regarded quality of care as their most important performance dimension, averaging close to 25% in relevance, whereas the literature predominantly uses operations to characterize hospital performance. Second, strategy and operations alignment was regarded considerably more important by the sampled leading hospitals, than how the literature regards it. Finally, it is important to emphasize once again that, whereas each hospital respondent demonstrated varying degrees of usage of each of the eight performance dimensions, the majority of the empirical literature only characterizes hospital performance from one or two performance dimensions.

Ultimately, the seven hospitals included in the sample would seem to have incorporated some lean enterprise principles in their hospital enterprise performance measurement. The values of multiple stakeholders were reflected (i.e. principle 2), a balanced concern towards operations, finance, and quality was present (i.e. principle 3), and a monitoring of strategy and operations alignment was followed (i.e. principle 1). However, further probing was necessary to interpret the lower scoring of key dimensions (e.g. social equity, organizational learning) and also inquire further about existing performance measurement practices.

6.3.3 Hospital benchmarking of performance

Further inquiry into the meaning of higher performance revealed that senior hospital leaders continuously benchmarked themselves using both internal and external data. To perform meant not only to increase their standing in terms of historic internal performance, but also to do so in relation to other *comparable* hospitals[70]. The most cited benchmark was "Hospital Compare" by the US Department of Health & Human Services (HHS 2011). Meanwhile, some of the hospitals used commercial benchmarks to measure

[70] While the use of external benchmarks was acknowledged, respondents emphasized the previously mentioned limitations in attempting to compare themselves with other hospitals. Furthermore, they unanimously clarified that their chief concern was that regulators and payers alike used such benchmarks to evaluate their performance, and hence they felt obligated to improve their standing in such benchmarks even though they had issues with their comparability limitations.

themselves against other hospitals in terms of their patient satisfaction (i.e. Press Ganey Associates).

Four key limitations were apparent in the external benchmarking of hospital performance. First, hospitals consistently relied on different benchmarks to measure themselves on different performance dimensions. Moreover, benchmarking instruments didn't allow for holistic performance measurement, therefore even if an effort was made to cross-reference two or more benchmarks, their analysis was derived from different baseline data. Furthermore, respondents promptly referred to their good results in specific benchmarks (and hence specific dimensions) and neglected to mention other benchmarks where they didn't perform as well. Second, quality of care was primarily measured with process based metrics (e.g. administering X within Y minutes in the presence of Z) and the little outcome based metrics used were basic (i.e. mortality and readmission rates). Third, metrics were aggregated at hospital level which lacked the granularity of specific service units (e.g. emergency care vs. inpatient care). Notably, gathering data at a lower granularity and at such magnitude (i.e. across all Medicare enabled hospitals) would imply a considerable cost and potentially an additional administrative burden. Finally, all hospitals were consistent in characterizing an overwhelming number of metrics being tracked at any point in time, and largely because of external stakeholder requirements (see Table 6-10). For instance, medium to large hospitals tracked as many as 300 to 400 quality of care related metrics in order to remain eligible for payment by various payers, including Medicare.

Table 6-10: Evidence of extensive list of externally required metrics

Hospital	Interview quote(s)
B	"We have a very long set of clinical targets." "The external ones tend to be more of reporting requirements." "I have to answer you with thousands of bullet points."
C	"We have no shortage of metrics! [chuckles] Some of them under care would be mortality index, readmission rates, CMS [Medicare] core measures for heart disease and pneumonia, HEDIS measures [which are for outpatient care] for diabetes and asthma, CMS surgical measures, NISQIP (surgical measures of performance and infection rates), performance of accreditation by the joint commission, etc"

D	"Oh we look at everything! [dismay voice][...] We have been measuring that forever."
E	"on the quality side as you know there is AHRQ and Quality Forum there is probably 350 outcomes you are looking for, from medication errors, to falls, to prevention, core measures... we lump all those core measures and everything together... attacking all of them at once..." "There are too many organizations out there demanding healthcare to do this... [...] These organizations come at you, be it CMS, be it AHRQ Quality Forum, and huuuumf! They overwhelm you! And they are all voluntary in a way, except for JACHO, and you know, so you are chasing your tail..."
F	"all of that data, very complex, complete... I shouldn't say complete... large set of data, [is] publicly reported for the most part." "I think anything that was below some sort of state or national average would be considered to be unacceptable or poor performance."
G	"I only keep track of very few metrics. The ones I just told you about. I know we track all the others, we have to for regulatory reasons"

Interestingly, the dimensions which scored lower in the previous subsection (i.e. social equity and organizational learning) aren't required by external entities and are absent from hospitals' external benchmarks, whereas those that scored higher (i.e. operations, finance, quality, patient satisfaction) feature prominently in said benchmarks. Therefore, despite the limitations of external benchmarks, these arguably also prompted senior hospital leaders towards improving and maintaining their performance at least above national averages.

6.3.4 Hospital internal measurement practices

Having established the considerable influence of external entities in hospitals' external benchmarking activities, we next probed further into their internal performance measurement practices.

To begin with we determined that the number of externally demanded metrics significantly outweighed the internal metrics, and in some cases comprised the whole dashboard for a given hospital. Additionally, several of the hospitals defined as strategic objectives the implementation of externally demanded metrics, and the improvement on the specific processes measured by said metrics. One of the respondents particularly conveyed this practice, as follows:

"A strategic objective would be to optimize patient satisfaction, and there is a series of process improvement steps under that. A strategic objective would be to be as safe as possible in terms of the 350 outcomes set by AHRQ [Agency for Healthcare Research and Quality]."

Hospital E CEO

In describing their internal performance measurement practices, all seven hospitals were consistent in characterizing a *cost center* based analysis of each service unit (e.g. emergency department, operating room per specialty, laboratory, etc)(see Table 6-11). Different hospitals had different levels of sophistication and depth in their cost center analysis practices. For instance, Hospital A expressed difficulty in keeping track of expenses as it couldn't afford an electronic medical record system capable of effectively capturing item charges (i.e. services and materials administered to each patient). Similarly, Hospital B also didn't have the benefit of a sophisticated billing system, but it instituted a line-by-line monthly analysis of each cost center with the senior leadership team. Furthermore, there was a specific focus on volume per service unit and volume per procedure. One CEO went as far as instituting a DRG level of focus in order to improve on each individual DRG and reach specific targets. Ultimately, each hospital had in place mechanisms to determine the contribution margin of each service unit.

Table 6-11: Evidence of cost center management practices

Hospital	Interview quote(s)
A	"we look at the financial reports that provide levels of contribution to the bottom line by department. We have revenues, net revenues, expenses [...] each department is measured on its contribution."
B	"I am a pain in the neck because I also go over every line item, in every cost center, with every senior manager every single month, and budget variance reports, so you can always see opportunities to get more efficient" "I really know where people are spending their money [shows me her folders with detailed line items]. So if we find that there are areas that we can get more efficient, we will definitely go about doing that"
C	"[performance is tracked] primarily through variations from budget, we track all the different departments and units, and they all have budgets. We track it weekly in terms of encounters, how many operations you do... more volume based. And then monthly we use aggregate numbers and calculate financials."
D	"every department had to develop a dashboard"

E	"We look at every DRG on mortality and complications and we are trying to stay above the 75% on every one, so anything that falls below that would be a missing objective"
F	"We are able to see the ratio of revenue to expense for each department on a monthly basis." "We typically have what we call a statistic… if it is the OR we look at cases per month against revenue and expense… or we might look at lab tests… so if someone has got a metric in terms of lab tests or x-rays, then we would look at their FTEs measured against that statistic, and their expenses against that statistic… Once you do that then you can look the next month and say "Okay, their volume was up but their expenses were the same, and their revenues were the same" That means that they perhaps are more efficient but also that their revenue is not as good as it might be. So it helps to kind of give you a point to measure both volumes, revenue, and expense on an ongoing basis. And therefore you can then look at other departments and then say "so, if your cost per statistic was X, and someone else's cost per their statistic was Y", you can kind of look at the department and see which managers are managing the tightest." "We look at contribution margin to services on a rotating basis… not probably as much as we should, but we do look at those, or at least we can look at those."
G	"we have a budget to meet for next year and that we have to decide where to cut expenses. And if people say "well I am not ready to cut expenses" then you say "I am sorry, we need to cut them, because the bottom line is the bottom line, so you have 30 days to come up with a conclusion". And if you can't come up with it then I will decide."

In general, the smaller or non-teaching hospitals observed that they made the most revenue from outpatient services, whereas the teaching hospitals regarded inpatient and procedural services as more profitable (see Table 6-12).

Table 6-12: Evidence of contribution margin awareness

Hospital	Interview quote(s)
A	"Small hospitals or critical access hospitals have the majority of their revenue in outpatient"" Radiology is the single largest contributor." "Rehab is next because there is very little supply cost... it is all people. And if you keep their schedules busy there is a good return"
C	"I think it is the procedural ones and they perform better for a couple of reasons. Obviously because the reimbursements are better. And they are more predictable." "it would be inpatient surgeries. More the high end surgeries: transplant surgeries, cardiac surgery, neurosurgery, urology."
D	"Probably oncology and endoscopy right now, and those are actually individuals, two doctors who bring the most money into this place. We do

	have some better paid services like digital mammography, sleep studies and so forth" "70% to 75% of your business is outpatient"
E	"The OR contributes to our bottom line substantially. Cardiac services. Those would be the major ones. I would tell you also that outpatient services contribute. We lose money in inpatient services. Outpatient services is what drives our bottom line."
F	"Pretty much all of the interventional procedures, so that would be surgery, radiology, certain oncology procedures, there is a pretty good margin for the lab, gastroenterology, so it tends to be procedure driven, cardiology, you know anything to do with stenting and interventional cardiology"

It is important to note however, that although cost center practices were indeed in place they weren't following an activity based costing approach whereby a focus is given to high profit margin services with the intent of lessening or discontinuing other services (see Table 6-13). Follow-on questions determined that CEOs were consistent in their mission value of delivering a viable and broad array of services. For instance, a hospital wouldn't close a service unit (e.g. emergency department) that had a negative contribution margin, if it was deemed essential to the surrounding community. Furthermore, some of the respondents noted that cross-costs existed whereby one service unit could in essence be supporting another service unit and they may lie at opposite ends of the contribution margin spectrum (i.e. residual contribution). However, the fact still remained that performance was being measured by cost center and in some case line-by-line.

Several reasons were identified to justify the cost center approach adopted by the hospitals. Several argued that said practices were to identify the efficiency opportunities, or any deviation from historic volumes. Additionally, some hospital leaders noted their need to know as precisely as possible how much each DRG would cost so that they could *cost shift* if need be in their negotiations with commercial insurance companies (i.e. cost shifting occurs when Medicare's reimbursements are insufficient to cover all of a hospital's expenses in a given DRG, hence prices charged to private insurance payers are increased for those specific DRGs). Similarly, the negotiation of capitation based contracts requires hospitals to be particularly knowledgeable about their underlying costs in administering care, so as to make sure that they negotiate adequate payments per

patient member per month. Moreover, hospitals had in place mechanisms to determine the contribution margin of each service unit, but they were aware, to some extent, of the limitations of such an approach, and didn't adopt a traditional activity based costing mindset.

Table 6-13: Evidence of non-activity based costing mindset

Hospital	Interview quote(s)
B	"if I discover the emergency room does not contribute to the bottom line, am I going to close it? Of course not! If I discover that orthopedics doesn't contribute to the bottom line, what am I going to tell a patient that shows up with a broken leg? So we budget the entire institution and we don't introduce services here [that can't pay for themselves]"
C	"the analysis that we currently do which is a relatively siloed analysis of revenues and expenses" "it is completely reimbursement driven: the reimbursements are pretty good given the amount of energy expended within each silo"
F	"we have to provide medicine for dermatology, or gastroenterology services, pretty much whether they are profitable or not, those are services that we wouldn't let go…" "the real trick for hospitals is to figure out how to mix the services and mix the paying patients so that you can make a margin. But it is not as though you can eliminate a particular service."
G	"on its face you would say that surgery provides more income to the bottom line. However, if you don't have a medicine department which is the intake for the patients in the first place, who then get referred to the surgeon, surgery can't contribute to the bottom line. So it is the integrated service that makes it work." "I am not sure that I could break down the service units in terms of each of the performance dimensions. I don't have enough knowledge of the various units to tell you how I would rank them in terms of efficiency, productivity, financial results"

Despite realizing the limitations of the cost center approach, it is also important to note that there were nonetheless secondary effects followed in the hospitals' performance measurement practices which didn't lend themselves to lean enterprise principles (see Table 6-14). For instance, despite recognizing the potential residual contribution amongst service units, some hospitals would refuse a service unit's improvement (e.g. add a robot; enlarge the emergency department; etc) if said service unit couldn't attract sufficient increased volume in order for the improvement to pay for itself. Another example was that all seven hospitals had in place productivity reward systems whereby the managers

of each cost center would receive a bonus for reaching a pre-defined target, and said bonus was specific to a service unit and did not account for potential service unit interdependency. Finally, and perhaps more importantly, the nature of the lean improvement initiatives in place were narrowly focused either inside a service unit (e.g. reduce ventilator associated infections in ICU; reduce time to be seen upon arrival in the emergency department; etc) or an isolated clinical support process (e.g. making a pharmacy drug available on an inpatient service unit). Moreover, hospitals were defining as strategic objectives the implementation of externally demanded metrics, and subsequently focusing on the improvement of the specific processes measured by said metrics.

Table 6-14: Evidence of less desirable effects of hospital performance measurement practices

Hospital	Interview quote(s)
A	"laboratory are best performing. The reason is because it is more of an automotive assembly line. They can reduce their steps in the laboratory to achieve better throughput. They can line up the equipment to get the most of their process. X-ray is probably second in that people come in usually for one test, you get them in, you get them to the test, you get them out."
B	"I had a group of clinicians think "can I have a robot", and I said okay, go out there and find out how many cases you would have for your robot, and then come back and let me know. People from Burlington Massachusetts aren't going to come here for that. You guys tell me how many cases you currently do that you would need to have a robot for, and if it is a lot of cases I will buy a robot because I've got money, and they didn't come back, and I knew they wouldn't come back because they don't have cases"
C	"I think that the ones with the most room for improvement are already the highest functioning ones. The ones with less room for improvement are those where we need more improvement. For instance, we might have a department that is very successful and we may have one which is less successful, so where should we invest in improvement? I think it is probably better to invest in the successful ones because they already have a track record at being successful."
E	"the emergency department. It is a process rich environment that lends itself to performance improvement" "When I got here we had 90,000 visits which is high, top 3 or 4 in the state, 70% of the people went to the waiting room, nothing good ever happens to you in the waiting room, probably 80% of patients weren't seen in 40 minutes upon arrival, now 90% are seen in 40 minutes upon arrival, 10% are in the waiting room or change hospital. So we have a whole series of PI [performance improvement] initiatives that may be more related to hotel function, or process innovations, many of them are

	related to quality outcomes, such as, ventilator acquired pneumonia we have zero, we have central line infections we have zero when we used to have 3 to 5%. I am not saying that we are great in every area, but we have very specific measures that we track and define high performance. And we are in evolution to continue to define even more as we go."
F	"our medication efforts have reduced the time from the ordering of the med to the delivery of the medicine to the floor from 90 minutes to 9 minutes, so that emphasis was great for patients because it is reducing error, but it is also creating efficiencies. The same thing in the operating room. The same thing in radiology. Typically those services tend to be more efficient whereas other services tend to be less efficient. Medicine for example is definitely not as efficient as overall as the other services."

Overall, lean improvement initiatives didn't cut across service units and were focused on externally set requirements, rather than internally defined strategies. For instance, the improvement of patient flow between two separate service units wasn't contemplated (i.e. principle 4 addressing interdependencies). Similarly, improvements targeted at specific isolated processes would improve efficiency within a given service unit, but potentially compromise overall effectiveness of said service unit, or those of others (i.e. principle 3 of focusing on enterprise effectiveness before efficiency). Ultimately, such practices were in line with the traditional interpretation of lean improvement (e.g. narrow process level), and indeed prevalent in the health care literature, and did not accommodate the broader considerations inherent in lean enterprises.

Finally when asked about their measurement practices of interactions with external health care providers, respondents consistently referred to the inflow of patients (i.e. patient referrals) and mentioned once again the existence of weekly and monthly volume based objective data tracking. Respondents proceeded with the characterization of outflow interactions (e.g. nursing homes, rehab facilities, etc) only after specific probing to that effect. Notably, only the two smallest hospitals have an annual face-to-face meeting scheduled with the two or three external providers they interact with. However, none of the hospitals had specific processes in place to rate an external interaction on an individual and systematic basis, nor are there any volume based metrics (e.g. external facilities that receive the most patients from them). External interactions are measured with perceptual data in sporadic reactive occasions whereby a hospital is informed by a

complaining external provider either directly or through an officially filed complaint. Ultimately, when asked for a scenario for when hospitals would indeed measure outflow in a systematic and rigorous way, respondents mentioned that payment models as a whole would have to value integrated care (i.e. global payment). In the words of one particular respondent:

> *"Well, over time if you think that we are going to have more integrated care across the spectrum of care, it will be more important to have better communication there for sure."*
>
> Hospital G CEO

6.4 Hospital Enterprise Capabilities

Our analysis this far has specifically discussed both direct and indirect consequences of explicit performance measurement practices, and in doing so, both positive and room for improvement opportunities were identified. Notably, an influential performance measurement paper proposed that enterprise performance measurement practices, whether "*used explicitly to influence behavior, to evaluate future strategies, or simply to take stock, will affect actions and decisions* [to the point that] *The firm becomes what it measures*" (Hauser and Katz 1998). However, our analysis also established that senior hospital leaders followed implicit practices (i.e. neither captured in their performance measurement practices nor in their mental models of performance measurement) which further explored to what extent hospital enterprise performance is currently being measured. Moreover, beyond performance measurement practices, "*lean enterprises are complex, highly integrated systems comprised of processes, products, organizations, and information, with multifaceted interdependencies and interrelationships across their boundaries*" (Nightingale 2002). What follows is a description of key enterprise capability themes that emerged consistently from the data across the hospital sample.

6.4.1 Hospital enterprise scale considerations

While describing the hospitals performance measurement practices, specific phenomena of interest emerged pertaining to the scale of the different hospitals.

Information technology (IT) capability related to hospital scale: in general, larger hospitals had greater information technology capability. Smaller leading hospitals compensate for their constrained IT environment with alternative human intensive processes (see Table 6-15). Specifically, hospitals A, B, and D, classified their underlying information technology capability as constrained at best. Hospital A doesn't have a sophisticated electronic medical record (EMR) system and instead relies on its CEO single handedly calculating and guesstimating the costs of each DRG with a calculator. Similarly, the hospital had recently significantly improved its accounts receivable and it attributed the improvement to the implementation of electronic billing. In the case of Hospital B, the CEO followed a cumbersome monthly line-by-line cost center review with its leadership team. Specifically, Hospital B didn't have the sophisticated billing systems and had to rely instead with the familiarity and commitment of its team. However, said process also helped in the planning activities as the key stakeholders were present and would readily negotiate and derive consensus as to which service unit(s) to invest in. Interestingly, Hospital B's CEO also noted that the process would only most likely work in an organization her size, and that a bigger organization would have difficulty in doing the same. The remaining hospitals were of medium to large size and relied on multiple information systems to capture, manage, and process data. For instance, Hospital D used a data warehouse to manage inpatient data (i.e. McKesson Horizon Performance Manager), and managed its emergency department with a different solution (i.e. Cardinal Health Pyxis), and yet another one to do run specific DRG financial analysis. Such systems were said to enable Hospital F to function in an efficient manner whilst supported with adequate performance measurement. However, Hospital C also alerted to the potential drawback of having highly expensive staff spending a significant amount of time clicking through different computer systems.

Table 6-15: Evidence of IT capability related to hospital scale

Hospital	Interview quote(s)
A	"it is almost a joke because sometimes payers will say " well what is your cost from doing this type of surgery?", I just start chuckling [...] It is me and my calculator when it comes to negotiating contracts. That is where we are at because we don't have those technologies or those sophistications, we know that we need to get it but I don't have the money to go buy it [...] everything is

	paper"
B	"if I told you how we budgeted here you would just die" "Now in a bigger organization this would be tough, but we have been doing this for so long that we can complete each other's sentences. We go over every line item and every cost center [...] So we do it together. It makes us all crazy but we do it together"
C	"IT is supposed to be an enabler to do the work. We haven't quite figured that out. We sort of dropped IT onto the practice. It is helpful in some ways because you get access to a lot of information quickly, but there are a lot of administrative clicks that have to happen."
F	"I think that the other thing that really bears a huge degree of importance around efficiency and measurement for that matter is the information system technology that you have, and we have a whole suite of products"

Smaller hospitals positioned as referral sources: hospitals A and D described that they had a smaller spectrum of services that they could offer to their surrounding communities, and that their positioning was to refer the more complicated cases to larger hospitals. Larger hospitals not only offered the broader spectrum of services, but also provided the back-office capability of electronic medical records and overall stability that the smaller hospitals felt they needed.

Smaller hospitals capable of managing outflow interactions more closely: hospital A, B, and D, described that they were able to hold bi-annual meetings with all the external health care providers which received most, if not all, of their patient discharges (e.g. nursing homes, skilled nursing facilities, rehabilitation centers, etc). Furthermore, given the smaller patient outflow network, these hospitals have high frequency interactions with each external provider, and hence there is closer proximity to discuss the performance of an interaction. Additionally, while the state of Massachusetts requires that hospitals respond within a week from receiving a formal written complaint, these hospitals had internal practices to do so within 48 hours and in some cases would offer for plaintiffs to meet with the CEO face-to-face.

Smaller hospitals tracked performance with absolute numbers: the smaller scale of operations at hospitals A and D was such that metrics were mostly tracked with absolute numbers, rather than using percentages. It may sound like a logical assertion however,

hospitals reported instances where they felt misrepresented by external benchmarks and consequently had to issue statements to manage public perception (e.g. explain seemingly high patient fall percentages or staff turnover).

Degree of CEO involvement in operations related to hospital scale: the CEOs of smaller hospitals reported to be closely involved with operational issues and in some cases there wasn't even a need for a Chief Operating Officer (see Table 6-16). Specific examples were requested and respondents were indeed able to discuss at length various issues of patient flow or emergency department improvements. As for the largest hospital its CEO readily referred to its COO in order to discuss operational matters in greater detail.

Table 6-16: Evidence of CEO Involvement in hospital operations

Hospital	Interview quote(s)
A	"In this smaller organization, I am knee deep in operations because of our size. We have no chief operating officer. I am it."
B	"I have been here a long time now. I really know what is going on here on any given day, so I don't micro manage, but I can get into the details really quickly, because the best ideas and strategies in the world, the cliché is right in that the devil is in the details, so I muck in the details if I need to, to get a big problem solved" "I really know where people are spending their money [shows me her folders with detailed line items]. So if we find that there are areas that we can get more efficient, we will definitely go about doing that"
D	"I describe my role as a hybrid of CEO and COO"
F	"Our size is such that we are big enough to teach and train and have great equipment and all, but we are also small enough that we have much less room between the CEO and the managers and the real operations. So we stay pretty close to the action."
G	"No one knows where the ship is going. Their problem is that they think we have to know. You can't know where the ship is going, this is health care. [chuckles]"

6.4.2 Leadership mindful and supportive of hospital enterprise behaviors

While describing the hospitals performance measurement practices, specific phenomena of interest emerged pertaining to senior leaderships' involvement in nurturing enterprise environments akin to those of lean enterprises (i.e. lean enterprise principle 6).

Senior leadership raising community awareness: previously we described how all respondents included as part of their hospital mission the requirement to deliver optimum care whilst remaining viable organizations. Several hospital leaders referred to their concern towards generating community awareness about the baseline challenges and opportunities that affect their hospital (see Table 6-17). To that effect, leaders considered essential to try to explain in simple terms the reasoning behind difficult decisions such as discontinuing a service unit, or resisting a service upgrade demanded by the surrounding community. Moreover, leaders attempt to explain basic concepts such as higher procedural volume being correlated with higher quality (and hence the issue of maintaining a low volume service unit), or the considerable investments required to acquire new technology. As a result, leaders said that the majority of their surrounding communities were themselves aligned with their hospital's mission, and were also better informed as to how they could do their part to help fulfill said mission (e.g. donations, volunteering, etc).

Table 6-17: Evidence of CEO management of community awareness

Hospital	Interview quote(s)
A	"The community would like to see cardiac caths, but as soon as we explained the reality, we advise them to go do it elsewhere because we don't have the numbers to have the quality. So we explain it to them and so they understand it."
B	"Employers in this community by association understand that we will discount but we will never discount, to insurance companies, to the point that we will go into the red. Because if we start going into the red then we can't deliver optimum quality care because we won't have the resources to do that" "And if they [the community] started making unreasonable demands of us, shame on me for not educating them better about what would be reasonable demands. But we maintain the distribution of a lot of literature within the community, we deliver a lot of benefits to the community, we interact with the community on a regular basis.
D	"Where we run into trouble is where they just don't understand how healthcare works, and we barely understand it ourselves, so it is hard to explain to them things"

Senior leadership disseminating mission across enterprise levels: several respondents described a concern towards engaging their employees, both clinical and otherwise, and enlightening them as to how their individual role relates to the overall hospital's mission.

CEOs of both small and large hospitals met with new groups of staff at orientation and explained what their hospital's mission was about and how they could contribute to it. Interestingly, one respondent shared his continued amazement at how non-clinicians were better able at identifying their contribution to the hospital mission. Specifically, the CEO would ask people "*tell me how what you do everyday relates to our mission?*". As an example, a non-clinician such as housekeeping was said to have answered that she kept rooms clean which helped avoid infections and allowed patients to go home sooner. Conversely, nurses were said to be unable to do the same and were hence coached by nursing leadership to better understand the connection between their role and the hospital mission. Similarly, another CEO considered as a key responsibility to clearly and constantly disseminate the hospital's mission (and vision) so that staff had it in mind while going about their daily work. Finally, one respondent noted her ongoing effort in establishing at least one metric and/or improvement initiative involvement, in order to clarify and sustain the connection between an employee's role and the hospital mission.

Senior leadership nurturing a safe and productive work environment: in describing how they derived higher hospital enterprise performance, several respondents converged in their mindfulness towards establishing and supporting desired enterprise behaviors (see Table 6-18). One CEO purposefully sought a balance in its middle management team such that some people were very data driven, while others were more relationship building oriented. Other CEOs noted the importance of empathy and creating and maintaining collegial relationships with medical staff both at a personal (i.e. respectfully listening to concerns and issues) and structural level (i.e. sustaining medical referral channels). Interestingly, the senior leaders of the teaching hospitals shared a concern towards shaping an enterprise environment conducive of higher performance. To that effect they outlined the importance of communication, culture, keeping employees satisfied, and ultimately focused in providing excellent patient care. One of the senior leaders went as far as studying the cultural fit of new physician hires so as to maintain alignment. Finally, several respondents emphasized the importance of being able to communicate with physicians in particular, in order to better manage their needs and also attain better receptivity of any planned change initiatives.

Table 6-18: Evidence of CEO nurturing and supporting hospital enterprise behaviors

Hospital	Interview quote(s)
A	"the single most important thing once you're inside the walls of a hospital, you have to know how to work with the doctors."
B	"I have incredible collegial relationships with the medical staff here both at personal and structural levels. It is personal in the sense that I am a real straight shooter who deals with people openly and fairly" "Where do the medical subspecialists docs get all of their referral from… primary care docs. So we have created structurally a very cohesive system"
C	"for the colleagues and physicians is primarily to create an environment where they are able to provide that excellent care and service" "Once you get in the door you can work some magic and that magic again depends upon the provider becoming an enabler by calling a colleague. There is something about willingness to see a patient when you are asked in a way that makes you feel good about it or you know that you are helping. It is a little different when you put something on your schedule, and you are told"
D	" you have to balance in a management team is that you have people who are very data driven, and people who are much more relationship building, when my balance gets off we are not as effective"
F	"the leadership that I provide goes a long way in creating an environment of accountability, and one of initiative and empowerment. So, I really try to create an environment that allows people to grow and is a great place to work" "the integration through good communication and culture, all of those things make a big difference. We look for physicians that will work well with one another" "our goal is to try keep the employees satisfied, and keep them focused on the bed side."
G	"I think that my job is to try to create an environment where they [clinical and non-clinical staff] are happy but as much as possible their being happy is consistent with what the hospital needs" "Empathy is the key. Having an understanding where individuals and groups of people and the organization as a whole are. In essence, what they are feeling about how things are going. Because then I can adjust the process for that it becomes more informative, more open, more whatever it needs to be, in response to that."

6.4.3 Hospital organizational learning capability beyond what is measured

While describing the hospitals performance measurement practices, specific phenomena of interest emerged pertaining to senior leaderships' understanding and concern towards enabling organizational learning characteristics (i.e. lean enterprise principle 7). The analysis in this subsection ascertained that hospital enterprises may be *beyond* what they measure (i.e. as opposed to being only what they measure).

Hospital leaders' misinterpretation of organizational learning construct: when describing their organizational learning practices, all of the respondents consistently referred to their employee training at a technical knowledge level (e.g. teaching medical students how to conduct a patient medical exam; teaching nurses how to clean a patient's wound; etc)(see Table 6-19). Further analysis of the respondents' remaining answers, as well of their hospitals' internal and public documents, established that the leading hospitals weren't measuring their organizational learning capability.

Table 6-19: Evidence of misinterpretation of organizational learning construct

Hospital	Interview quote(s)
A	"You can tell I have less emphasis on organizational learning... because we should get the people already learned... they should already be here ready to do their job"
D	"One of the things that scares me the most [about organizational learning] is just the aging workforce and the knowledge drain that is going to happen when these people leave, and don't have things written down, it is going to be very hard on a lot of organizations including our own"
E	"The whole learning organization concept... we are focused so much on survival here... when I came in we were losing $25M. We do have a corporate university, and we do have 10 training hours per employee per year."
F	"[Organizational learning] We don't do well here..."

However, it is also true that some of the hospitals had evidence of concern and predisposition towards organizational learning, although they neither interpreted it as such, nor did they measure it (see Table 6-20). For instance, while Hospital F's CEO self-assessed its enterprise organizational learning as poor, the senior leader espoused continuous improvement as its definition of high hospital enterprise performance. Similarly, Hospital A's CEO said he didn't emphasize organizational learning (i.e. the opposite of lean enterprise principle 7) and yet he espoused continuous improvement.

Table 6-20: Evidence of organizational learning phenomena

Hospital	Interview quote(s)
A	"Our objective is to continuously improve. Constantly moving forward is the key."
B	"Part of my speech to employees is "given what we do, we can never be too good at it""

D	"You know, the really strategic goal of quality is perfect care. Not too many people have dared to put that down in their public documents yet, but that really is the goal. And you know, I used to think that it was high in the sky, but you know, there was a day where we used didn't think you could have no ventilator associated pneumonia, no bed sores, and things like that, and today we don't!"
F	"Number one it means beating our own best score so we often measure ourselves against our past performance of the hospital. We think that we get better that way. The second is that we always try to find a benchmark where we can, where we believe it is apples to apples, so we always try and show our data with a benchmark. That is what it means to perform, so that we are constantly improving."

Clarifying what is meant by organizational learning in this research: given hospital leaders' unfamiliarity with the academic organizational learning construct, we next revisit what is meant by organizational learning in the context of this research. Organizational learning scholars often refer to an early study by Hayes et al (1988) which attributed the higher performance of manufacturing plants to each enterprises' ability to learn, thereby deriving sustained improvement in performance over a long period of time. Since then, considerable territory has been covered on the subject, and given rise to different interpretations of organizational learning amongst scholars themselves. Edmondson and Moingeon (1998) provide a useful literature review on organizational learning using a 2x2 matrix. Research contributions are essentially described at two different levels of analysis (e.g. organization vs. individual) and using two different research approaches (e.g. descriptive vs. interventionist). For instance, the seminal book by Senge (1990) is classified as an interventionist research approach focused at an individual level. It is interventionist in that the researcher prescribes specific policies that allow an organization to adopt organizational learning practices and become a learning organization as an outcome. It is considered at an individual level as Senge is said to focus on individual level characteristics such as mental models (e.g. deeply engrained assumptions), and personal mastery (i.e. individuals who seek to continuously learn). However, Senge could conceivably argue with said classification as he defined learning organizations as "*organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see*

the whole together" (Senge 1990). Moreover, an organization as a whole is clearly referred to in the preceding definition. Similarly, from our own literature review one could argue that another relevant dimension would be the source or trigger of the observed phenomena (i.e. external environment vs. internal to the organization). For instance, whereas Edmondson and Moingeon (1998) focus on an organization's adaptability (i.e. learning occurs when addressing an external challenge and/or opportunity), Senge (1990) explicitly designates *adaptive learning* as well as *generative learning* (i.e. internal learning stimulus) as necessary for organizations to survive and thrive.

Ultimately, our purpose here isn't to agree with a particular characterization of a scholar's research contribution, but rather to explain how organizational learning can generate different opinions amongst scholars themselves, thereby prompting us to further clarify its meaning in the context of this research. As per Chapter 2, the lean enterprise principle of emphasizing organizational learning, embodies the continuous experimentation and knowledge gain at all levels of the enterprise with both top-down and bottom-up orientation. A key aspect is that the enterprise as a whole must be able to learn and benefit from localized improvement efforts, so that it in turn may improve the effectiveness of the improvement efforts undertaken. Furthermore, our research design is primarily descriptive of existing organizational learning practices of leading hospitals, as well as prescriptive, whilst informed by our literature review and empirical expertise with lean enterprise principles. All in all, this thesis' research design covers both axis of the organizational learning matrix described above. As such, it is important to also note that this thesis' research questions are addressed in the context of Chapter 6, 7, and 8, thereby also including the required in-depth exploratory study of leading hospitals (see Chapter 5's Research Roadmap).

Hospital capabilities *beyond* what is measured: as noted earlier, analysis established that hospitals had evidence of concern and predisposition towards organizational learning, although they neither interpreted it as such, nor did they measure it. What follows is a description of enterprise practices shared by some of the hospital leaders and which lend

themselves to those of organizational learning (see Table 6-21).

Table 6-21: Evidence of unmeasured organizational learning practices

Hospital	Organizational Learning Practice(s)
A	Leverage and appreciate employee driven process deviations that are reasonable and improve patient satisfaction with hospital services rendered.
B	Empower knowledgeable employees to tackle problems locally while mindful of the whole hospital, and doing so effectively, efficiently, clearly, and swiftly.
D	Invest in people's betterment and training so that they remain engaged, productive, and motivated.
H	Encourage accountable, objective, and participatory decision making amongst all employees, whilst investing in their personal and professional development, and appreciating their contribution.

The CEO of Hospital A shared that he and his managers systematically engaged top performing employees who had been worthy of direct reference by patients in feedback surveys. First, the CEO wanted to understand what the particular employee did that deserved the positive feedback. Second, if the employee deviated from existing processes, and did so in a reasonable manner, managers studied how to incorporate it into their existing standard protocols. Third, top performing employees were recognized by the CEO both via a personal letter and a semi-annual staff party where they were appreciated in front of everyone. Moreover, the CEO recognized that employees could change processes in a reasonable manner and help the hospital fulfill its mission of keeping its patients healthy and satisfied.

The CEO of Hospital B, the best financially performing hospital in Massachusetts (as measured by its operating margin), emphasized the importance of empowered knowledgeable managers and quick turnarounds. Specifically the CEO referred to an enterprise policy of "*not processing things to death*". An operational problem identified on a Monday would be notified to the manager of the respective service unit, who would then work on it on Tuesday, and develop and implement a prototype solution within a single week. Alternatively, if the problem wasn't considered a priority, managers were instructed to communicate clearly when and how the problems would be addressed, and in doing so, they would manage potential employee frustration and orchestrate their

involvement in a potential solution. Additionally, the CEO noted that any problem being addressed is done so in the context of the whole hospital and the wider health care system. Finally, the CEO stressed the importance of recognizing the professional contribution that each and every employee provided either directly or indirectly to patients.

> "*People who work here understand health care, they understand the broader dynamics of what is going on, they understand the nitty gritty aspects of operations, they can quickly see through the core of a problem or issue. You'll pardon the expression, but none of us are bullshitters... we are just really efficient and effective at getting stuff done*"
>
> Hospital B CEO

The CEO of Hospital D shared that she and her senior managers not only focused on each service units' resources and local leadership, but also on its *personality*. Specifically, it was noted that some service units would consistently rate the hospital poorly on different internal surveys (e.g. diversity; engagement; facility; etc). The primary factor said to contribute to a negative service unit personality was the career prospects of its respective employees who *felt trapped* in their positions. As such, senior leaders instituted the practice of engaging employees and asking them "*if you really want to get out of this service unit, how are you going to do it?*". The rationale is to keep employees engaged and motivated about their prospects, and support them in their development if need be.

The CEO of Hospital G, the largest hospital in the sample, made the interesting distinction between process and content when describing how he steered the enterprise towards its high performance status. Specifically, the CEO didn't force upon others his particular point of view on a given problem (i.e. content), and instead focused on facilitating meetings with stakeholders from multiple service units, and encouraging them to openly and objectively discuss potential solutions (i.e. process)[71]. In doing so, the CEO

[71] Notably, the distinction between process and content is commonly used in the strategic management literature when studying organizational decision making and performance (Ketchen, D. J., J. B. Thomas, et al. (1996). "Process, content and context: Synergistic effects on organizational performance." Journal of Management **22**(2): 231-257.). Process research focuses on the activities that led to and supported strategic decisions (i.e. how strategy is formed) whereas content research focuses on the nature of decisions (i.e. what is decided).

mentioned his baseline trust in employees' willingness to do well and to do good, while feeling themselves accountable (as opposed to being made accountable) in conducting systematic analysis of stakeholder values and potential barriers to implementation. Finally, the CEO also noted the hospital's commitment to recruit, retain, and provide personal and professional development for employees throughout the organization, while at the same time valuing and recognizing their distinguished contribution towards the hospital mission.

> *"part of my job is to help ensure that that knowledge bubbles up through the organization and that it is actually used in a productive way [...]. From my style of things, in addition to having trust with people, you also have to have real great comfort with ambiguity as to where the place is going to go and how it is going to get there. This is not hierarchical top down management in that sense. It is in the sense that I'm creating the construct that we are working in. That is the only top down thing that I am doing. The process.[...] What I care about is that the group of people who are knowledgeable about [a problem], have worked well together, and have come up with a rigorous decision that makes sense to the organization."*
>
> Hospital G CEO

Hospital practices inconsistent with those of learning organizations: although in the previous subsection we identified hospital capabilities absent from their performance measurement practices, here we also note that some of the respondents described practices were inconsistent with those of learning organizations. Earlier we noted the literature's distinction between organizational learning research and learning organizations research. Whereas organizational learning research is said to encompass descriptive research, learning organizations research prescribes policies to continuously improve organizations. Specifically, "*given the variety of phenomena labeled organizational learning, the learning organization rubric can be used to separate research aimed at developing strategies to improve organizational adaptiveness from the larger body of work* [which includes descriptive research]" (Edmondson and Moingeon 1998). We find this distinction useful in that it explicitly denotes that organizational learning practices alone are insufficient to confer an organization with a learning

organization capability. Moreover, a learning organization is one which follows policies that encourage a combination of organizational learning practices. As such, our analysis of the seven Massachusetts hospital senior leaders, also identified practices that weren't consistent with those of learning organizations:

- Organizational learning concerns all levels of the enterprise: in describing their improvement objectives and associated practices, most senior leaders exclusively focused on their senior leadership team and service unit managers. However, organizational learning also concerns, and indeed depends on, the individuals who are in non-management /leadership positions (e.g. nurses, physicians, supply techs, pharmacy techs, etc).
- Organizational learning stems from external and internal stimuli: in describing their internal measurement practices, all respondents consistently referred to the adoption of externally demanded metrics and subsequent process improvement initiatives targeted at said metrics. However, organizational learning not only concerns adaptability (i.e. external stimuli) but also internal generative learning (e.g. figuring out how to improve a process even though said process isn't directly monitored/demanded by external entities).
- Local improvement efforts with an enterprise level mindfulness: in describing their improvement practices, and indeed as delineated in internal hospital documents, several respondents narrowly focused inside service units (e.g. reduce ventilator associated infections in ICU; reduce time to be seen upon arrival in the emergency department; etc). However, a learning organization is one able to learn and benefit from localized improvement efforts whilst being mindful towards enterprise level effects and potential opportunities to replicate results.

6.5 Towards Lean Hospital Enterprises

At the beginning of this chapter we referred back to our assessment of the literature's sparse empirical evidence as to what extent hospitals are adopting a multidimensional perspective of performance, hence this thesis' first research question: *How is hospital enterprise performance currently measured?* As evidenced in our analysis in the previous

sections, although the sampled leading hospitals were following practices beyond those characterizing them in the performance related literature, they also exhibited dysfunctionalities from a lean enterprise perspective, and hence the second research question: *How could hospital enterprise performance measurement be improved using lean enterprise principles?* Notably, our phenomena of interest emerged within and beyond each hospitals' explicit performance measurement practices, which is in line with the understanding that "*the full benefits of lean can be realized only by re-thinking the entire enterprise*" (Nightingale 2002).

This section is structured in two parts. First, we summarize our findings pertaining to the leading Massachusetts hospitals' performance measurement practices. Second, we propose specific practices and metrics where appropriate, informed by lean enterprise principles, so as to assist hospitals in improving their performance measurement practices.

6.5.1 Findings summary

The seven leading Massachusetts hospitals' external environment was found to be consistent with that of the health care literature reviewed in Chapter 4. Succinctly, hospitals grappled with low financial margin, medicine's continuous evolution, and are highly prone to value misalignments induced by external entities such as payers and regulators. Similarly, we found that the respondent data is also consistent with the health care literature reviewed in Chapter 2 insofar as the designation of senior hospital leaders' most measured performance dimensions (i.e. Operations, Finance, and Quality) and two of the lesser ones (i.e. Organizational Learning and Social Equity). However, we also identified key departures from the literature which led us to conclude that, unlike the literature's characterization, hospitals do have a multidimensional appreciation of performance.

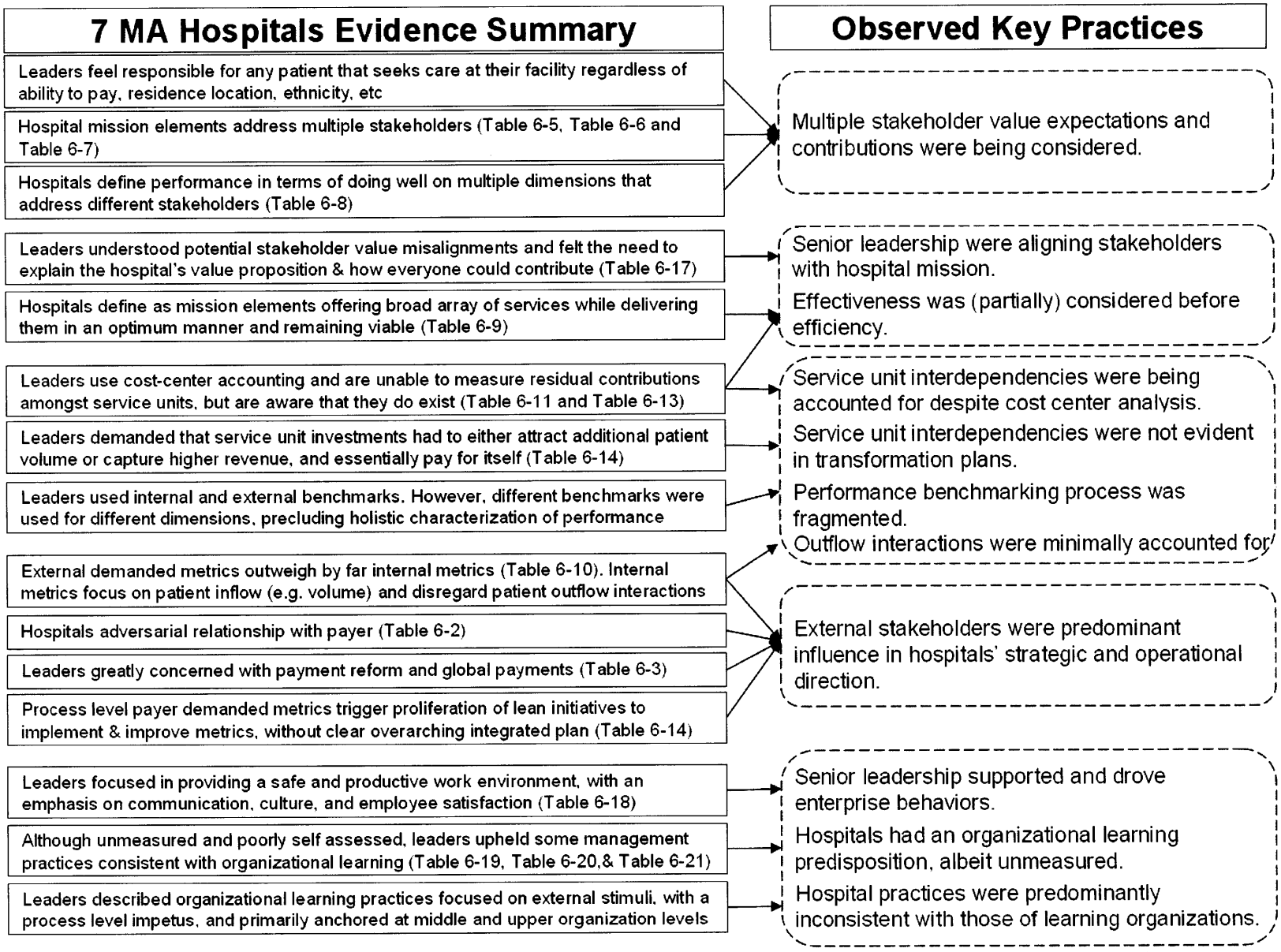

Figure 6-2: 7 MA Hospitals Evidence Summary and Observed Key Practices

Figure 6-2 above provides an overview of the key findings stemming from the studied seven leading Massachusetts' hospitals. The detail pertaining to the evidence listed on the left side of the figure has already been presented and discussed in this chapter's previous subsections.

Meanwhile, a description of the key findings listed on the figure's right is provided in Table 6-23. These findings were generated from the hospitals' explicit and implicit performance measurement practices and are assessed in terms of one or more relevant lean enterprise principles (summarized in Table 6-22 and explained in detail in sections 2.4.5 and 2.4.6). Furthermore, the key findings are grouped according to five themes which form the basis of the recommendations, diagnostic questions, and metrics presented next in section 6.5.2.

A simple coloring scheme is used in Table 6-23 to help readily visualize the alignment of hospital enterprise practices with lean enterprise principles (i.e. green denotes good alignment, whereas yellow denotes some alignment, and red indicates poor alignment and most room for improvement).

Table 6-22: Summary of MIT LAI's Lean Enterprise Principles (Nightingale 2009)

Lean Enterprise Principle	Description
1	Adopt a holistic approach to enterprise transformation
2	Identify relevant stakeholders and determine their value propositions
3	Focus on enterprise effectiveness before efficiency
4	Address internal and external enterprise interdependencies
5	Ensure stability and flow within and across the enterprise
6	Cultivate leadership to support and drive enterprise behaviors
7	Emphasize organizational learning

Table 6-23: Summary of leading hospitals lean enterprise practices

Lean Enterprise Principle(s)	Description
2	Multiple stakeholder value expectations and contributions were being considered: senior hospital leaders share a multiple constituency view of their enterprise, and are concerned almost entirely with the same set of key stakeholders. These include patients, their families, the surrounding community, the hospital's Board of Trustees, physicians, regulators, employees, and payers. Furthermore, hospitals' performance measurement practices included different performance dimensions that catered specifically, or on aggregate, to different stakeholders. For instance, "patient satisfaction" pertains to patients, whereas "quality" mostly concerns regulators and payers, and "employee satisfaction" addresses employees.
2, 6	Senior leadership were aligning stakeholders with hospital mission: Externally, several of the leaders felt the need to engage with their surrounding community so as to generate awareness about their hospital's baseline challenges and opportunities, and in doing so, explain potentially difficult decisions about to be taken, and/or clarify how the community could help the hospital fulfill its mission (e.g. volunteering, donations, expectation management, etc). Internally, several respondents described a concern towards continuously walking the floor and engaging their employees, both clinical and otherwise, so as to enlighten them as to how their individual role relates to the overall hospital's mission.
2, 3	Effectiveness was (partially) considered before efficiency: senior hospital leaders emphasized their concern towards balancing the needs of different stakeholders as well as performing well in multiple dimensions. For instance, an ailing critical service unit wouldn't be closed if the surrounding community didn't have a reasonable alternative. However, leaders also recognized that patients (as well as other stakeholders) may at times look at things from a keyhole and satisfying their individual needs could potentially comprise the hospital's viability as a whole. Conversely, those that value employee satisfaction noted that investing towards a satisfied workforce was critical for the hospital to succeed as a whole.

Lean Enterprise Principle(s)	Description
4 	Service unit interdependencies were being accounted for despite cost center analysis: previously we mentioned that senior leaders wouldn't close a critical service unit if the surrounding community didn't have a reasonable alternative (i.e. external interdependency concern). Senior leaders verbalized a similar concern towards internal interdependencies in recognizing that some service units are tightly integrated with each other, hence a negatively performing unit may have a residual contribution towards other positively performing units. However, even the most sophisticated measurement systems in place didn't account for the recognized service unit interdependencies, and the fact still remained that performance was being measured by cost center and in some cases line-by-line. Furthermore, hospitals had a focus on volume per service unit and volume per procedure (i.e. reflects their payment model incentive) and were also concerned in improving on specific DRG's (i.e. increase their Medicare profit margin) which invariably implied focusing on service units as independent entities (i.e. managers rewarded on an individual service unit basis). Ultimately, senior leadership had a theoretical sense of service unit interdependencies but their performance measurement systems only adopted a cost center based analysis.
1, 3, 4 	Service unit interdependencies were not evident in transformation plans: most likely a reflection of external stakeholders setting the direction, the lean improvement initiatives described by senior hospital leaders, as well as those within internal hospital documents, not only didn't cut across service units but also failed to consider beyond the process level. Notably, such neglect is in line with the traditional interpretation of lean (e.g. narrowly focused on the process level) which is prevalent in the health care literature. Additionally, some hospital leaders emphasized that service unit improvements would have to pay for themselves, which in the context of the previously mentioned cost center analysis, would further neglect potential service unit interdependencies. Ultimately, hospitals were missing the opportunity of architecting improvement efforts such that they would benefit from cumulative benefits both at an enterprise level and in the long run.
1 	Performance benchmarking process was fragmented: senior hospital leaders benchmarked themselves using both internal and external data, and defined performance in relation to their historic performance, as well as that of similar hospitals. As such, leadership made a consistent effort towards evaluating their performance in the context of the overall health care system. However, it did so in a fragmented manner given that it used different benchmarks for different performance dimensions. Moreover, benchmarking instruments used different baseline data which precluded the holistic characterization of hospital enterprise performance.

Lean Enterprise Principle(s)	Description
1, 2, 4 	Outflow interactions were minimally accounted for: when elaborating on their interactions with external health care providers, senior hospital leaders consistently only referred to inflow of patients. Targeted probing revealed that patient outflow interactions were only managed with perceptual data and mostly in sporadic reactive occasions. Notably, smaller hospitals were able to hold annual face-to-face meetings with the external providers (e.g. nursing homes, rehab, etc). However, the fact still remains that no specific processes were in place to rate external interactions on an individual and systematic basis. Additionally, senior leaders shared that they would improve their outflow interactions management, only if payment models would value integrated care (i.e. global payment). Arguably, a lean hospital enterprise would seek to manage its inflow and outflow interactions in equal measure, and a positive outflow interaction would potentially translate itself into fewer resources spent in said interactions, and also increase overall enterprise public perception (i.e. support and increase patient inflow).
1, 2, 3 	External stakeholders were predominant influence in hospitals' strategic and operational direction: the number of externally demanded metrics significantly outweighed the internal metrics, and in some cases even comprised the whole dashboard for a given hospital. Notably, one component of this behavior is that different payers demand several different metrics and outright deny payments if hospitals don't report on said metrics. Hence, unless factors change in hospitals' institutional layer, such will likely continue to take place. However, it shouldn't preclude hospital efforts towards adopting sound lean enterprise practices. For instance, senior leaders defined as strategic objectives the implementation of externally demanded metrics, and the improvement on the specific processes measured by said metrics. As a result, hospitals' transformation strategies were not only set by external stakeholders but also tended to lack a clear overall rationale (if any). As such, improvement efforts focused on efficiency (i.e. improve at external metric X) and potentially compromised overall hospital effectiveness.
6 	Senior leadership supported and drove enterprise behaviors: in describing how they derived higher hospital enterprise performance, several respondents converged in their mindfulness towards establishing and supporting desired enterprise behaviors. Senior leaders shared a concern towards shaping an enterprise environment conducive of higher performance by keeping employees satisfied, communicating clearly, nurturing and sustaining the desired culture, and ultimately focusing on the delivery of excellent patient care. To that effect, senior leaders used a series of different practices, including a mix of quantitative and relationship driven managers, and nurturing collegial relationships with medical staff in particular. Ultimately, respondents were sensitive and committed in their support of enterprise

Lean Enterprise Principle(s)	Description
	behaviors, as well as in encouraging others to do so.
7 	Hospitals had an organizational learning predisposition, albeit unmeasured: several senior leaders were concerned and had a predisposition towards organizational learning and continuous improvement, although they neither interpreted it as such, nor did they measure it. To that effect, senior leaders used a series of different practices targeted at different aspects of their enterprise. Examples included the empowerment of knowledgeable employees to tackle problems locally while mindful of the whole hospital, and doing so effectively, efficiently, clearly, and swiftly. Others encouraged accountable, objective, and participatory decision making amongst all employees, whilst investing in their personal and professional development, and appreciating their contribution. Ultimately, senior leaders' negative organizational learning capability self-assessment did not adequately reflect their capability (i.e. respondents reference model inaccurately interpreted what organizational learning meant). However, albeit an unmeasured capability, the capability that they did have in place wasn't consistent those of learning organizations (see practice below).
1, 3, 4, 6, 7 	Hospital practices were predominantly inconsistent with those of learning organizations: although hospitals had organizational learning capabilities they had inconsistencies that prevented them from behaving as learning organizations. Firstly, senior leaders targeted their senior leadership team and service unit managers, hence they didn't engage all levels of the organization (i.e. top-down and complete bottom-up orientation). Secondly, improvement effort descriptions mainly stemmed from external stimuli (i.e. adaptive learning) and didn't include generative learning (i.e. figuring out how to improve a process even though said process isn't directly monitored/demanded by external entities). Thirdly, improvement efforts and transformation plans tended to be narrowly focused inside service units, and didn't have a description of potential enterprise level effects and opportunities to replicate results.

In reviewing the summarized analysis in Table 6-23 one can establish that the sampled leading hospitals were following different lean enterprise principles to different levels. Senior hospital leaders, together with the cross-validation of their hospitals' internal documentation, were well aligned in terms of principles 2 and 6, and to some extent principle 7 also. Conversely, respondents had critical areas with room for improvement in terms of principle 1, 3, and 4. Furthermore, although the 5th lean enterprise principle (i.e. ensure stability and flow within and across the enterprise) wasn't dominant in the analysis, one could argue by inference from principles 1 and 4 in particular, that the sampled hospitals, very likely weren't well aligned with principle 5 either.

In Chapter 2, while analyzing lean failures described in the literature, we referenced that lean is "*not so much about the individual principles and practices, but their effective integration and application*" (Nightingale 2002). With that in mind, our analysis in Table 6-23 suggests how multiple principles may interconnect in explaining the characterized hospital enterprise practices. For instance, said interconnections have common themes (e.g. external stakeholder influence) which contribute to different enterprise behaviors. Also, although some principles may be well reflected in a hospital's characterized practices, they may also have opposite readings when considering another set of practices for the same hospital. Moreover, respondents didn't consistently follow lean enterprise principles in measuring and managing their hospital.

All in all, the analysis established that senior hospital leaders did well on some lean enterprise principles, but had to improve so as to do so consistently, as well as in other critical areas.

6.5.2 Lean Enterprise Principle recommendations for hospitals

Having summarized our findings of leading hospitals' performance measurement practices, we next provide recommendations based on lean enterprise principles and in terms of key criteria and metrics where appropriate, as to how senior leaders could improve hospital enterprise performance measurement. As per our findings in the previous section, the sampled hospitals weren't consistently following lean enterprise

principles, as evidenced by their different measurement practices. Figure 6-3 provides an overview of each one of our recommendations and how it stems from the key findings from our analysis of the seven leading Massachusetts hospitals[72]. Notably, although using a different set of research instruments, the exploratory research of the two hospital in-depth cases presented in Chapters 7 and 8 also provided further evidence in the definition of our recommendations' key criteria and metrics.

Given the degree of fragmentation in the health care industry (e.g. regulatory requirements; payment models; health care providers; etc), and the associated effects observed in the previous section's characterized hospital enterprise practices, it is remarkable that the researched hospitals remain steadfast in pursuit of their mission, as well as operating in the black. However, the senior leaders of said hospitals also shared their concern in that they didn't know for how much longer they could remain as such, and were hence appreciative of lean enterprise principle recommendations that they could themselves implement. As such, the proposed recommendations necessarily take into account what is generally controllable by hospital enterprises, what they can influence, and ultimately the constraints set upon them[73].

A different focal unit of analysis (e.g. non-acute care provider; an insurance company; etc) would have implied a different research sample and most likely a different set of recommendations. Moreover, in line with this thesis' research motivation, the following recommendations recognize hospitals' difficult environment and specifically address practices which senior hospital leaders can readily work towards implementing or seek to influence others in their implementation. While doing so, we were also cognizant of how our analysis established that leading hospitals in Massachusetts share several mission organizational elements, as well as a concern towards a similar set of key stakeholders. Nonetheless, an effort is also done in using specific examples that refer to both hospitals in general, as well as to those hospitals with specific typological characteristics.

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[72] Figure 6-3 uses the same coloring scheme used in Table 6-23 to help readily visualize the alignment of hospital enterprise practices with lean enterprise principles (i.e. green denotes good alignment, whereas yellow denotes some alignment, and red indicates poor alignment and most room for improvement).

[73] Said approach (i.e. control, influence, and constraints) is espoused by one of the lean enterprise principles themselves, namely in the need to address both internal and external enterprise interdependencies (i.e. lean enterprise principle 4).

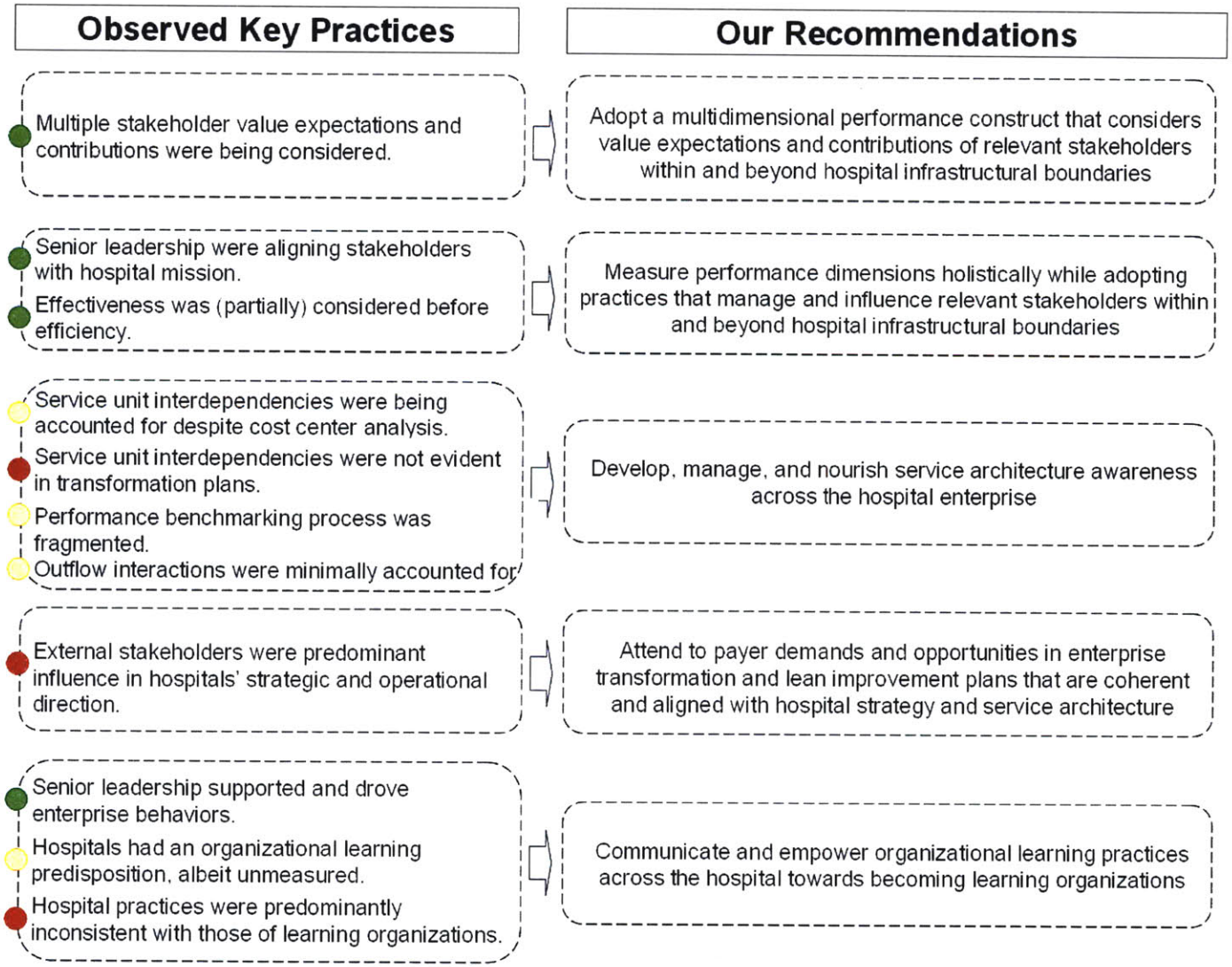

Figure 6-3: Lean Enterprise Principle Recommendations for Hospitals

Adopt a multidimensional performance construct that considers value expectations and contributions of relevant stakeholders within and beyond hospital infrastructural boundaries

Hospital enterprises deliver a value proposition which involves multiple stakeholders that may have values that aren't necessarily aligned with one another. A lean hospital enterprise is one which doesn't focus on a single final patient, or a set of insurance companies, but rather on multiple stakeholders. These include patients, their families, the surrounding community, the hospital's Board of Trustees, physicians, regulators, employees, payers, as well as others.

For instance, patients are active participants in the care that they receive, both within and beyond a hospital's infrastructural boundaries. A patient that is readmitted to a hospital within 30 days of an inpatient discharge and presents himself with similar symptoms, is by definition a patient stay which isn't reimbursed by payers, hence it is in the hospital's best interest to improve the care processes as well as communication with the patient, so that (s)he receives and follows the best treatment available. Furthermore, a happy patient is one more likely to recommend the hospital in the future to someone else.

In turn, physicians are critical in several dimensions, including the care that they provide to patients as well as the patient flow control that they have (i.e. *the power of the pen*). Physicians appreciate their autonomy, but increasingly work in multispecialty teams, and are ultimately the ones held responsible for the care that is provided (e.g. they are targeted in negligence lawsuits). Hence, being able to attract and retain great physicians is essential for a hospital to function and sustain operations. The mechanisms that rule the contractual relationship between a hospital and a physician are varied (e.g. salary model, physician organization contract, etc), and what is important is to have a baseline understanding of where everyone stands (e.g. payer incentives, technology requirements, faculty affiliation, etc) and take that into account when defining and executing the hospital's strategy.

Finally, payers (e.g. insurance companies, Medicare, etc) also control the patient flow as they specify which physicians are included in a health plan's network, and consequently control which hospitals they can refer patients to. Payers are characterized as extremely demanding of hospitals in terms of what they should track and report on, as well as in their contractual negotiations (e.g. designing a fee schedule; determining the monthly payment per member in a capitated plan; etc). Payers leverage their information of multiple provider operations and attempt to institute best practices in hospital operations as well as minimize their payments for specific services.

Ultimately, the realization that there are multiple stakeholders that contribute and expect value to and from hospital enterprises, isn't new for senior hospital leaders. There may be hospital leaders that favor one particular stakeholder group, but in general they are aware of multiple stakeholders. However, a hospital's performance measurement system should necessarily include different performance dimensions that cater specifically, or on aggregate, to different stakeholders. To that effect we propose eight performance dimensions and identified the specific metrics which consistently ranked highest amongst the sampled hospitals (see Table 6-24)[74].

Table 6-24: Sampled hospital highest ranking metrics per performance dimension

Dimension	Metric(s)	Metric(s) definition
Customer Satisfaction	Patient intent in recommending facility in the future	Would you recommend this hospital to your friends and family?
	Patient satisfaction survey	Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?
Employee Satisfaction	Employee satisfaction survey	Using any number from 0 to 10 where 0 is the least satisfied possible and 10 is the most satisfied possible, what number would you use to rate

[74] Please refer to Appendix II for the full list of metrics which were presented to all CEO respondents and derived from the literature. Please note that respondents were allowed to add additional metrics if they felt necessary, and only in the case of "*days of cash on hand*" did they add the metric and also consistently regarded it as one of their highest ranked metrics within the Finance dimension. All remaining metrics in Table 6-24 were derived from the literature and consistently ranked highest by CEO respondents.

Dimension	Metric(s)	Metric(s) definition
		your satisfaction at this hospital?
	Nursing turnover	Total nurses who left / (total nurses – new nurse hires)
	Service unit harmony	Perceptual assessment of employee satisfaction and overall service unit climate
Finance	Total operating margin	(total revenues - total costs) / total revenue
	Operating expenses	Total
	Days of cash on hand	Cash/ ([operating expenses - depreciation expenses]/365)
Operations	# ambulatory visits	Total
	# emergency visits	Total
	# inpatient days	Total
	# inpatient surgeries	Total
	# outpatient surgeries	Total
Organizational Learning	Employee training expenditure	Total
	Proportion of new technology investment	New technology investments/ Total investment (equipment, real estate, technology, etc)
Quality	Effectiveness of clinical care	Series of evidence based medicine process checks [e.g. % children immunized, % mammography in target population, etc]
	Mortality rate per type of procedure	Total number of deaths per type of procedure / total number of patients per type of procedure
	Complications and/or adverse events	Total
	Rate of patient readmission within 30 days of discharge	Total number of readmissions / total number of patients discharged
Social Equity	Patient mix by payer group	Patients grouped by payer type (e.g. Medicare, Medicaid, Blue Cross, etc)
	Patient mix by geography	Patients grouped by zip code
Strategy/ Operations Alignment	Balanced physician incentives	Detect overuse or underuse of specific procedures, pharmaceuticals, etc, per physician

Once again, upon inspecting Table 6-24 it is evident that the sampled hospitals were using a multidimensional performance construct which considered the value expectations and contributions of relevant stakeholders within and beyond infrastructural boundaries. Some of these metrics are further evidence of the strong influence that payers have in hospital operations. For instance, the customer satisfaction metrics are derived from a required survey called HCAHPS (Hospital Care Quality Information from the Consumer Perspective[75]). Similarly, three of the four quality metrics are required by payers. Furthermore, the higher ranking metrics for the operations dimension illustrate the sample hospitals concern with carefully tracking patient volume, which in most cases reflected their fee-for-service payment arrangements[76]. Finally, it is also evident that the metrics used for Organizational Learning are representative of the semantic gap previously described in section 6.4.3. Notably, each our remaining recommendations includes criteria and metrics where appropriate, to assist senior hospital leaders in improving their hospital performance measurement practices, and Organizational Learning is one of them.

Ultimately, in line with the performance measurement literature guidelines reviewed in Chapter 2, the following diagnostic questions are suggested for hospital leaders to evaluate their performance measurement practices in terms of our first recommendation:

- Does the hospital performance measurement contemplate the 8 performance dimensions of quality, finance, operations, patient satisfaction, employee satisfaction, organizational learning, strategy/operations alignment, and social equity?
- Are stakeholders within and beyond hospital boundaries contemplated in the hospital's performance measurement?
- Are short-term and long-term objectives reflected in each performance dimension?
- Is there a balance of financial and non-financial metrics in place?

[75] See http://www.hcahpsonline.org/home.aspx
[76] See Chapter 4 for definitions on payment models.

Measure performance dimensions holistically while adopting practices that manage and influence relevant stakeholders within and beyond hospital infrastructural boundaries

Adopting a multidimensional performance construct with appropriately selected metrics and recognizing the existence of multiple stakeholders in a hospital enterprise environment are necessary but insufficient conditions. Senior hospital leaders' actions and their underlying performance measurement systems and practices stand to benefit from embodying said conditions. Specifically, performance dimensions and metrics shouldn't be considered in isolation but rather, in relation to each other, so as to identify necessary tradeoffs and opportunities for reinforcing values. Ideally, tradeoffs are avoided and win-win performance dimension relationships are established.

To that effect, senior hospital leaders should engage in dialogue with physicians, nurses, and other employees, so that they understand existing challenges and why a particular demand has remained unanswered. Examples include encouraging employees to propose ideas, or make requests, but always in the context of wider implications (i.e. beyond the individual stakeholder's perspective). For instance, a physician who has recently attended a conference and saw the latest innovation in his field, and who wants to encourage hospital leadership to adopt it, should do so with a sound business model behind it. Conversely, senior hospital leaders are advised not to continuously rely on the good will of dedicated employees in order to maximize the throughput of an existing plant. Attaining higher throughput, and effectively reducing the cost per treated patient, may also imply a gradual deterioration of employee satisfaction, which sooner or later has a knock-on effect on patient satisfaction (e.g. poor relationships between care givers and patients and/or family members) and other performance dimensions (e.g. tiredness increases the probability of medical error; dissatisfied nurses leave).

Similarly, senior hospital leaders should also engage with their surrounding communities, and not only with their Board of Trustees and internal stakeholders, so as to explain the key challenges faced by the hospital and how the community can help in overcoming them. Specifically, engaging with the surrounding community isn't limited to patient

wellness programs (e.g. exercise, diet, etc) or fund raising activities. A community hospital in attempting to offer as broad array of services as possible must be cognizant of the quality of care it can provide, and whether it can amortize its capital investments. To that effect, it is critical that the community understands the relationship between case volume and quality of care (i.e. the more cases a physician does the better the outcome). Also, the community must be made aware of the costs of technology, training, etc, so as to understand the hospital's decisions in managing its service portfolio.

Ultimately, high hospital performance implies performing well in multiple performance dimensions simultaneously. Focusing on a single dimension is likely to jeopardize the effectiveness of the hospital enterprise as a whole (e.g. keeping surrounding community happy at the cost of financial stability; efficiently discharging patients earlier at the risk of inferior quality of care; etc). To that effect we propose that performance measurement practices explore the relationship amongst performance dimensions, and have senior leadership engage with relevant stakeholders to explain and reinforce said relationships.

Once again, the following diagnostic questions are suggested for hospital leaders to evaluate their performance measurement practices in terms of our second recommendation:

- Are hospital leaders aware of both the tradeoffs and complementing values inherent in the 8 performance dimensions?
- Does patient centeredness strongly influence the interpretation of the values of each performance dimension?
- Are external stakeholders fully leveraged and informed in terms of the value that they can deliver and expect to and from the hospital?
- Are physicians fully engaged with the hospital in jointly negotiating service contracts with insurance companies?

Develop, manage, and nourish service architecture awareness across the hospital enterprise

A hospital's service architecture is comprised of several service units (e.g. emergency department, operating rooms, laboratories, etc) which function with varying levels of interdependence amongst them. Such interdependence may imply sharing scarce resources and/or producing services to support another service unit. As such, either a cost center based performance measurement, or a mere theoretical appreciation of service unit interdependence, are insufficient approaches to adequately characterize and manage a hospital's service architecture. Moreover, a hospital's performance measurement and management practices should help develop and maintain service architecture awareness.

However, a hospital's service architecture shouldn't end with a consideration for its internal service units. Recognizing that external health providers are essential should be reflected not only in a concern towards measuring patient inflow volume, but also that of systematically measuring patient outflow (i.e. interactions with nursing homes, hospital transfers, rehab facilities, etc). For instance, measurement shouldn't only concern itself with patient volume but also include other factors such as physician satisfaction (e.g. primary care physician content with the information exchange about his or her patient) and timeliness (e.g. patient seen within a reasonable timeframe).

Furthermore, planning and executing lean improvement initiatives requires service architecture awareness, so as to avoid improvement plans that look disjointed and risk merely optimizing processes at a localized level. Moreover, when describing high performance or strategic objectives, senior leaders wouldn't only focus on a given service unit, or worse yet on an individual metric, and would instead elaborate on an end-to-end view as to how one improvement initiative connects with other initiatives and influences other interdependent service units.

Additionally, senior leaders would be able to devise improved reward systems such that the joint efforts of two or more service units are taken into account, rather than

potentially incentivize a divide and conquer mentality amongst their managers. Similarly, senior leaders should encourage every employee not only to understand how their individual role contributes to the hospital's mission, but also how their activities may impact those of others upstream and downstream in the service architecture.

Ultimately, developing service architecture awareness across the hospital enterprise is a core capability that will help elevate hospitals from traditionally narrow lean health care definitions, as well as from less favorable performance measurement practices. To that effect, it is key to have integrated electronic information systems capable of tracking workflow. However, existing state-of-the-art electronic medical records are generally only focused in providing clinical related data, as well as financial charge capture information.

Over the course of the in-depth exploratory hospital cases described in Chapters 7 and 8 the phenomenon of service architecture awareness also emerged from the data and was found to be instrumental towards hospitals providing patient centered care while maximizing throughput across multiple service units. Each of the studied hospitals had different electronic information systems capabilities and such affected our ability to readily measure the service architecture awareness. In both in-depth cases the suggested diagnostic questions were prototyped, refined, and replicated, and functioned as a proxy to measure the service architecture awareness. However, key metrics (see Table 6-25) were also developed while leveraging the state-of-the art (albeit fragmented) electronic information systems of one of the in-depth cases (i.e. Chapter 7).

To the author's knowledge the suggested metrics aren't recommended in the literature and weren't in use at any of the hospitals studied in the context of this research[77]. Notably, both of the hospitals featured in the in-depth studies have now adopted as regular measurement practices both several of the suggested metrics, as well as the diagnostic questions.

[77] Sampled hospitals include the seven Massachusetts hospitals and the two in-depth exploratory hospital cases described in Chapter 7 and 8.

Table 6-25: Hospital service architecture awareness metrics

Metric	Description
Average emergency department (ED) boarding time	Patient boarding occurs whenever a patient is admitted in the ED, but remains in the ED because of a lack of inpatient resources (e.g. beds, nurses, etc).
Average ED boarding time per inpatient service unit	This metric identifies inpatient service units which admit ED patients faster/slower.
Ratio of operating room (OR) cases cancelled for non-OR issue	This metric keeps track of the OR cases which were cancelled because of issues residing beyond an ORs boundary (e.g. recovery bed not available; ancillary tests not available; patient not consented; etc).
Ratio of OR cases delayed for non-OR issue	This metric keeps track of the OR cases which were delayed because of issues residing beyond an ORs boundary.
Average consult response time per specialty	Consult refers to inter-specialty advice requested on a patient (i.e. patient in location X, seen by specialty Y, is consulted by specialty Z). In general hospitals have policies in place for consults requested from the ED in terms of the maximum allowable time between a request and service rendered. Traditionally consults are only tracked in terms of volume (i.e. for billing purposes) and not in terms of timeliness. Beyond the ED it is common not to have any consult policy in terms of maximum allowable time.
Inpatient service unit patient specialty density	Centralization of patient types in specific inpatient service units increases coordination efficiency (i.e. patients belonging to a specific specialty are grouped together), improves quality of care (e.g. nursing staff care for higher volume of patients of a given type), and has the potential to improve staff communications. Ideally each inpatient service unit has one or two predominant specialties (three at most). The metric may deteriorate as patient flow worsens and patients are no longer being grouped together.
(total revenue, total expenses, total patients, total inpatient days) per admission source	This set of metrics allows senior leaders to be cognizant of the ED's contribution to inpatient operations (i.e. patients that were admitted from the ED). Traditionally, ED services in the USA aren't reimbursed if a patient is admitted to the hospital, hence the ED's contribution is unknown.
Total new patient per admission source	For each patient visit determine whether he or she had already been a patient in the previous 24 months. If not, how many were patients who first came into contact with the hospital through the ED? This metric recognizes that an ED may be the first point of contact for a patient and may indeed serve as a means of enlarging the hospital's market share.
Primary care physician (PCP) satisfaction	This metric actively seeks to determine whether a PCP was satisfied with the care provided to his or her referred patient, as well as with the post-treatment communication.

Once again, the following diagnostic questions are suggested for hospital leaders to evaluate their performance measurement practices in terms of our third recommendation:

- Have end-to-end patient value streams been mapped from all points of entry (e.g. emergency department, clinic, internal)?
- Do lean improvement plans reach beyond the boundaries of individual service units and contemplate end-to-end patient flow?
- Are employees from different service units asked to rate each other's service unit performance?
- Are employees aware of how their local activities are affected or may affect other upstream and downstream service units?
- Do information and materials flow transparently in a standardized, tracked, and timely fashion within and across service units?
- Are there incentives in place to promote and support cooperation amongst service units?
- Is performance assessed across the service architecture as opposed to individual cost centers?
- Are outflow interactions (e.g. nursing homes, hospital transfers, etc) tracked systematically and objectively?

Attend to payer demands and opportunities in enterprise transformation and lean improvement plans that are coherent and aligned with hospital strategy and service architecture

The difficult relationship between hospital providers and payers is well documented and was consistently present across the leading hospitals included in this research. In an ideal world, the demands of different payers would be aligned therefore enabling hospitals to report on fewer metrics and to focus their transformation efforts in a less fragmented fashion. However, it is fair to say that more often than not, hospitals don't have the required bargaining power in order to adopt practices to manage and influence the behaviors of those paying for their services. There are some exceptions, for instance when hospitals have a monopoly of a geographic region, or have forged sufficiently strong strategic alliances (e.g. Partners Healthcare in Massachusetts) that enable them to reportedly negotiate better prices with payers. However, regardless of a hospital's negotiating position with payers, its leaders should attend to their demands and opportunities while executing enterprise transformation and lean improvement plans that are coherent and aligned with a core strategy and service architecture.

To begin with, negotiating fee-schedules or even global payments necessarily implies an adequate understanding of the true costs and capabilities required in providing care to each individual patient. Hospitals are increasingly being required to do more with less, and to accept greater risks when negotiating their contracts with payers. Hence, a service architecture awareness and measurement would better inform decision makers throughout their negotiations with payers and mitigate risks (i.e. related to our 3rd recommendation). Similarly, a closer relationship between hospitals and physician organizations allows for an improved bargaining position next to insurance companies (i.e. related to our 2nd recommendation).

Similarly, a decision to increase the offering and/or performance of a given service unit (e.g. invest in marketing plan to attract new patients; build new operating rooms; implement electronic medical record; etc) whilst responding to an external stimuli, should

take into account the existing service architecture and study whether other areas will also be affected and hence also need to be included in both the transformation and lean improvement plans. Moreover, strategic and operational planning should evaluate and focus beyond what is required or offered by external payers.

At a more granular level, the implementation and improvement of operations in terms of an externally demanded metric, ought to be considered in relation to the hospital's long-term strategy, and other improvement initiatives underway. It wouldn't be advisable to invest on implementing and improving upon a costly metric if the underlying process has very little representation in terms of patient flow for the given hospital. As an example consider a hospital that responding to a payer incentive, hired external lean consultants, and committed a 10 element team of physicians and nurses over one week, in order to specifically improve the process of emergency department (ED) patients that required a contrast scan, when less than 2% of the ED's patients needed to go through that process.

Ultimately, despite the high degree of influence from payers, senior hospital leaders should consider their core strategy and service architecture whenever making a decision on how to respond to an external stimuli, and indeed when hopefully executing in accordance to their own internal stimuli.

Once again, the following diagnostic questions are suggested for hospital leaders to evaluate their performance measurement practices in terms of our fourth recommendation:

- Does patient centeredness strongly influence the strategic direction?
- Are lean improvement plans directly linked with transformation plans and in turn with specific external challenges and/or opportunities?
- Are lean improvement plans mapped and coordinated across the hospital's service architecture?
- Do strategic plans make allowances for anticipated gains of lean initiatives?

Communicate and empower organizational learning practices across the hospital towards becoming learning organizations

In Chapter 1 we noted that today one would be hard pressed to find a hospital in the US which isn't aware of lean principles and considering the implementation of some kind of lean program (Liker and Morgan 2006). However, often times said hospitals focus on one or two lean tools and their approach narrowly focuses both at a process level and within individual service units. Additionally, and particularly in the case of larger hospitals, organizations institute internal lean courses where they teach both senior leaders and middle managers about the core concepts of the Toyota Production System. In fact, it isn't uncommon for hospitals to measure their lean adoption in terms of the number of people, and the number of hours, dedicated undergoing lean training. Ultimately, as argued in Chapter 2, to become a lean hospital enterprise senior leaders need more than a lean training program or a reduced set of tools targeted at individual silos. "*The journey to world class status is made up of thousands of small steps in which each improvement opens up the possibility of more improvement*" (Maskell 1991).

However, our analysis of the hospitals included in this research also determined that hospitals had an unmeasured organizational learning predisposition which enabled their respective organizations with key elements that were aligned with lean enterprise principle 7 (i.e. Emphasize Organizational Learning). As with the measurement of service architecture awareness, we developed a set of diagnostic questions to measure/ characterize the in-depth studied hospitals learning organization capability. Notably, a literature review on organizational learning capability measurement reveals a similar approach where diagnostic questions are asked on a scale of 1 to 10, and an aggregate result assesses the surveyed organization. Three particularly useful publications provide a detailed literature review and propose similar multidimensional organizational learning capability surveys with a total of 60 scales shared between them[78]:

[78] Please refer to Appendix III for further details on each of the multidimensional organizational learning capability surveys.

- (Goh and Richards 1997): Clarity of purpose and mission; Leadership commitment and empowerment; Experimentation; Transfer of knowledge; Teamwork and group problem solving
- (Hult and Ferrell 1997): Teams orientation; Systems orientation; Learning organization; Memory orientation
- (Jerez-Gómez, Céspedes-Lorente et al. 2005) : Managerial commitment; Systems perspective; Openness and experimentation; Knowledge transfer and integration

Upon reviewing the literature and the analysis of the hospitals sampled in this research we recommend that senior hospital leaders should shape an enterprise environment that is conducive of higher performance by keeping employees satisfied, communicating clearly, nurturing and sustaining the desired culture, and ultimately focusing on the delivery of excellent patient care. Senior leaders and managers alike need to engage and nurture collegial relationships with employees in order to have an understanding of their organization beyond statistics. Conversely, management should benchmark themselves using historic data as well as comparable external benchmarks, while cognizant of the limitations of said benchmarks.

Organizational learning should occur top-down and bottom-up within the hospital enterprise, and beyond improvement projects that were devised to adapt the hospital to external challenges and/or opportunities. Moreover, whether originated in internal or external stimuli, knowledgeable individuals should be empowered to swiftly tackle problems locally while mindful of the hospital's service architecture and doing so in an effective, efficient, and clear manner. To support such efforts, active participatory decision making is to be encouraged, whilst at the same time nurturing a sense of accountability and rigorous analysis that further reinforces self-learning and service architecture awareness. Finally, individuals and service units should be recognized for their efforts, and called upon in championing and sharing their learning to other parts within the hospital.

Ultimately, for a hospital to work towards becoming a learning organization it needs to be cognizant that organizational learning practices are necessary but insufficient by themselves. This observation specifically takes into account a lean enterprise perspective and explicitly goes beyond the three publications referenced earlier. Hence, we further suggest that the lean enterprise principle 7 be reworded to "*Emphasize becoming a learning organization*", as opposed to only emphasizing organizational learning in its title.

Once again, the following diagnostic questions are suggested for hospital leaders to evaluate their performance measurement practices in terms of our fifth and final recommendation:

- Have hospital leaders developed an internal compelling case for lean enterprise transformation?
- Have hospital leaders disseminated throughout the enterprise a common vision from the envisioned transformation and lean improvement plans?
- Are lean champions identified throughout the service architecture and visibly supported by senior leadership?
- Are cross-specialty and multiservice unit employee teams jointly engaged in respectful and trusting collaborations while devising and executing lean improvements?
- Have resources been made available to support initial momentum building lean improvements?
- Is there a process in place to leverage localized learning at a hospital enterprise level?

6.6 Chapter 6 Summary

In this chapter, we coincided with the literature in characterizing hospitals' difficult enterprise environment, whereby external stakeholders, mostly payers, have significant influence in hospital operations. Examples include the incentives that insurance companies present to unsalaried physicians, as well as the extensive list of metrics which

hospitals have to report and improve upon if they wish to remain eligible for reimbursement.

In studying ***how is hospital enterprise performance currently measured***, we established that the seven leading Massachusetts hospitals not only adopted a multidimensional performance construct but also defined hospital enterprise performance as remaining viable organizations whilst scoring well in as many performance dimensions as possible. Clearly, the sparse empirical evidence in the healthcare literature with regards to hospitals considering performance as a multidimensional construct isn't representative of their actual practice. Moreover, all hospitals in our sample provided empirical evidence that they had a multidimensional performance construct in place. Also, we determined that the sampled leading hospitals were consistently following some lean enterprise principles in their explicit and implicit performance measurement practices. Interestingly, senior hospital leaders were exhibiting behaviors beyond those described in their explicit measurement practices.

However, we also noted how hospitals were adopting some performance measurement practices which encouraged narrow thinking as well as a focus on inflow operations, as opposed to the whole patient value stream (e.g. including outflow). Similarly, improvement initiatives and enterprise transformation plans generally reflected a narrow focus on either an individual service unit or the process layer, and were only adaptive/ reactive as opposed to also being generative (i.e. internally driven). Moreover, there was evidence that some of the hospitals' performance measurement practices weren't aligned with lean enterprise principles.

Broadly speaking, today one would be hard pressed to find a senior hospital leader who wasn't familiar with terminology such as *continuous improvement* and *journey towards perfection*, and who wouldn't use said terminology in describing his or her own practices. However, how one goes about pursuing improvement and perfection, and how one measures performance, ultimately serves as a proxy as to whether or not they are indeed progressing towards becoming a lean hospital enterprise. With that in mind **we made 5**

general recommendations as to how hospitals can incorporate and benefit from lean enterprise principles. In doing so, we introduced a core concept of **service architecture awareness** which should be embedded at all levels of the hospital enterprise and inform the planning and execution of lean improvement initiatives, transformation plans, organizational learning, and performance measurement in general. A total of 26 diagnostic questions were suggested for senior hospital leaders to evaluate whether or not they are currently following our 5 recommended practices. Additionally, we identified 22 specific metrics for the 8 performance dimensions previously recommended. Furthermore, 9 new metrics were suggested specifically to measure service architecture awareness in a hospital context.

In the next chapter we present the first of our two in-depth exploratory studies of leading multispecialty hospitals, as we empirically and theoretically enrich MIT's Nightingale-Rhodes Enterprise Architecture Framework (NREAF) whilst exploring in detail whether an enriched understanding of hospital enterprise architecture can improve hospital performance.

7. US Hospital In-Depth Case Study

As noted in the introductory chapter, a key motivation for this research was to address the joint call of the National Academy of Engineering and the Institute of Medicine's to promote the application of "*principles, tools, and research from engineering disciplines associated with the analysis, design, and control of complex systems*" (Reid 2005). To that effect the previous chapters included an in-depth literature review of enterprise performance (Chapter 2), lean enterprise principles (Chapter 2), and enterprise architecture (Chapter 3), as well as our answers to the first two research questions (Chapter 6).

In Chapter 3 we determined that MIT's emerging Nightingale-Rhodes Enterprise Architecture Framework (NREAF) offers the most complete conceptualization of organizations and was thus selected to inform this research. We also highlighted the need to empirically study and theoretically enrich MIT'S NREAF while studying hospital enterprises in particular.

What follows is the first of two in-depth exploratory studies of leading multi-specialty hospitals in the United States (US) and United Kingdom (UK) respectively. Despite being ranked at the top 1% acute hospitals by various third party agencies in their respective countries, both hospitals were facing increasing pressure in specific functional areas. The US based hospital was grappling with a nationwide problem of Emergency Department (ED) overcrowding, whereas the UK based hospital was readying itself for an increased governmental pressure to shorten elective treatment waiting lists. Both *burning platforms* served as different entry exploratory questions which is consistent with the case study research strategy[79]. Additionally, and consistent with the nascent phase of EA's theoretical development, each case study comprised a series of inductive – deductive cycles that leveraged both quantitative and qualitative evidence while continuously comparing and contrasting analysis with the relevant literature. Furthermore,

[79] For further detail please refer back to section 5.2.4.2.

research cycles occurred within each case as well as across cases, which not only bolstered the case findings but also further refined the contributions to all four research questions posed in this thesis.

This chapter starts out by introducing US Hospital XYZ and presenting its history followed by a description of senior leadership's initial problem statement. The subsequent five subsections describe in detail different embedded units of analysis, both individually and in relation to each other, namely the ED, Clinical Support Services (i.e. pharmacy, labs, housekeeping, and bed board admissions), Administrative Support Services (i.e. process improvement engineers, performance and planning managers), Senior Leadership, and Inpatient Service Units. Each subsection analyzes qualitative and/or quantitative evidence as these became available from building a trust based relationship with the organization and identifying additional data sources. In essence, inquiry was informed by and reflected both lean enterprise principles and the MIT's NREAF. The latter part of this chapter provides an overview analysis of Hospital XYZ's enterprise architecture, while discussing the resulting enriched NREAF, and whether an enriched understanding of hospital enterprise architecture can improve hospital performance.

7.1 Hospital XYZ Enterprise and its History

Hospital XYZ is a non-profit physician led medical center and teaching hospital[80] with a longstanding culture of specialized teams directly available to individual patients from the local community and elsewhere.

Hospital XYZ began in the 1920s as a physician group practice similar to that of the Mayo Clinic or Cleveland Clinic and equally had its origins in surgical leadership. The practice started as a for-profit organization with a single surgeon who quickly made a name for himself and attracted an increasing number of patients and soon after, other surgeons wanted to join him. As the surgeries became more complex he hired medical

[80] Hospital XYZ is classified as a "Major teaching hospital", as it is a member of the Council of Teaching Hospitals and Health Systems (COTH). Hospital XYZ has a total number of 130 FTE interns and residents.

physicians to help support the surgical practice. When the surgeon founder passed away a board of overseers was formed and the group practice remained for-profit and was essentially run by a lawyer. However, the lawyer's tenure was short lived as the physicians felt that the practice was being poorly run, and was neither meeting their needs nor those of patients, thus they decided to overthrow the leadership and incorporate themselves as a foundation under a not-for-profit model.

Over time, the group practice tried to engage in joint ventures with surrounding hospitals so as to improve its contractual relationships but was consistently rejected. As such, in the late 1970s the group practice decided to build its own hospital, but such an effort was also initially unsuccessful as it was unable to purchase its intended prime real estate. Coincidentally, one of the board members worked in a company that had some land to sell and even though it wasn't in an ideal location at the time, given that all other options had already been exhausted, they decided to build their hospital 30 miles from the nearest major city. In the end it turned out to be the best location possible as the highway system evolved and the city center became further congested and less accessible to surrounding communities. Notably, the state's planning commission approved the hospital's construction only on the condition that primary and emergency care components be added to its services. Nonetheless the group practice leadership continued to perceive itself primarily as a tertiary diagnostic center, and to this day it is the reputation that they strive for and identify themselves with.

> *"Our character is specialized care and not to be a community hospital [...] the hospital is an extension of the group practice, as opposed to all the other places where the hospital existed and individual physician practices developed to support the hospital."*
>
> Hospital XYZ Chief Operating Officer (COO)

In the early eighties Hospital XYZ's CEO decided to retire and in the advent of the capitation payment model[81] being introduced, his replacement decided to pursue it and gear the organization towards it. In principle, under capitation, providers are given an

[81] Under a capitation model a provider is paid by a health plan a fixed amount each month for each member in its patient panel, regardless of the actual expenses incurred in caring for those patients (see section 4.4.1).

incentive to keep patients healthy and out of the hospital, but they also bear an increased risk of patients becoming ill and thus need to reach a larger patient population to distribute that risk.

> *"You get so many dollars per member per month to help take care of people, and you need to have a large number of lives, because if you just take care of sick people you lose your shirt, and if you don't keep growing and adding people you risk your population just getting older and sicker. So covered lives became important and geography became important. Because when you go to insurers you want to take care of a geographic area, [and] the larger that area the more you can try to generate from the insurers because they need you to take care of people. So geographic spread and covered lives was how you made your money."*
>
> Hospital XYZ COO

Therefore the capitation model prompted Hospital XYZ to acquire existing physician practices in the region and in doing so increase its geographic spread and number of covered lives. The ultimate goal however was to feed the hospital's tertiary care services in order to sustain the number of specialists that were needed to continue to meet their growth aspirations. In the end the model failed for them for three main reasons. Firstly, although care givers were said to be oblivious of a particular patient's health plan, the organization described itself in a *schizophrenic state* as senior leadership was well aware that it got paid less money the more resources that were spent taking care of capitated patients. Secondly, the organization felt that the health plans meddled too much in their affairs and demanded extensive utilization reviews which often resulted in unpaid insurance claims. Thirdly, although the health plan said the organization was responsible for managing the capitated patients, it allowed patients to seek care elsewhere and Hospital XYZ was ultimately responsible for any costs incurred by them at any other facility.

The alternative to capitation was to continue to grow in a fee-for-service model whereby any procedure is reimbursed at a previously negotiated price, and in the process avoid the perverse incentives of cutting patient care costs. In doing so the value of the primary care network was to strictly feed the hospital's tertiary care services and ancillary services

such as radiology, laboratory, and so forth. Realizing that patients were only willing to drive 10 to 20 miles to their point of care, leadership decided not to renew their contracts with any community care practices beyond that range from their hospital. Furthermore, the current COO devised a growth strategy centered around key specialties or service lines which were epidemiologically aligned with the needs of the surrounding patient population, and where Hospital XYZ could build a strong reputation of excellence.

For the past 10 years the hospital has been successful in fulfilling its aggressive growth strategy as illustrated in their growth margins over the same period, namely in surgeries (45%), patient discharges (36%), and outpatient encounters (24%). In 2006 the hospital derived close to $700 million in operating revenues which translated into an operating income of $50 million, and at a time when most hospitals in the region were struggling to breakeven. With over 4000 staff and close to 300 patient beds, they have national and international recognition in particular for their Cerebrovascular Disease Center, Liver Transplantation Team, and Heart & Vascular Center. Furthermore, Hospital XYZ also plays a significant role in clinical trials for new diseases therapies, and hosts residency and fellowship programs.

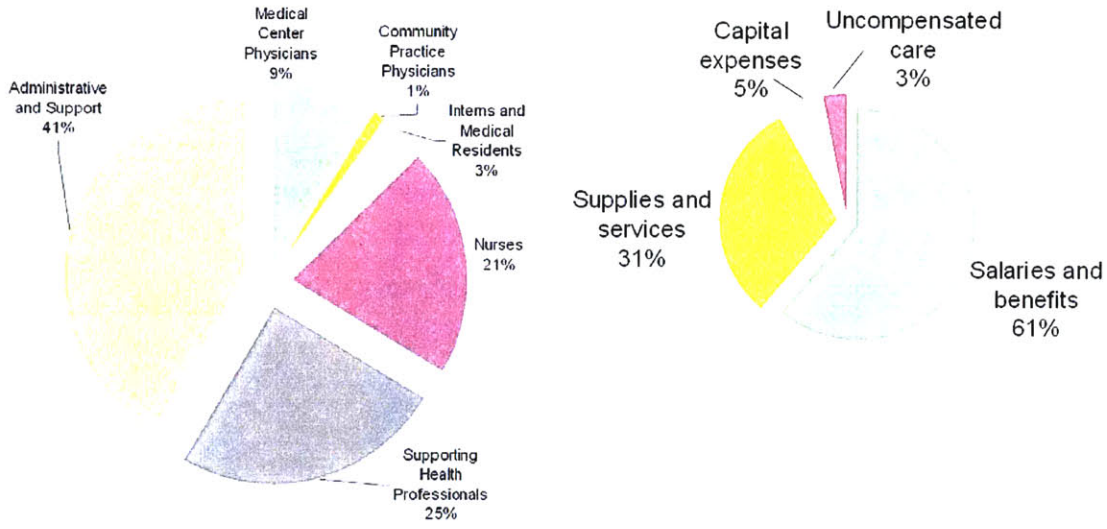

Figure 7-1: Hospital XYZ Staff and Operating Expenses

7.2 Senior Leadership Initial Problem Statement

The overcrowding of emergency departments (ED) has become an increasing national problem in the US as well as in Canada, Australia, and elsewhere (Derlet and Richards 2000). Hospital XYZ was no different and in 2006, having registered 36,000 patient visits to its emergency department, it was visibly struggling with patient overcrowding. As such, when senior leadership was approached in the context of this research they specifically requested that analysis focus inside their ED as evidenced in an internal memo circulated to ED staff which was entitled "*Moving Forward: MIT Student*" and described the intent to devise "*a plan to redesign work and care processes to streamline and improve patient flow, reduce waste, and improve safety and quality of care, the patient experience, and quality of work life for colleagues*" (XYZ_Chief_of_Strategy 2007). Leadership's proposed initial exploratory question was "*How to speed patient flow in the ED?*"

When asked for their own perception as to why the ED was experiencing such difficulties senior leadership provided two main reasons and suggested some solutions ahead of time. Firstly, only one other hospital remained open in the immediate vicinity and it too was struggling with ED overcrowding stemming from fewer emergency beds being available in the area. However, unlike the clear strategic imperative to grow the number of elective surgeries, the hospital had no desire to have a larger ED.

> *"We want to do 5% more surgeries. We want to do x% more of admissions. We sort of plan for volume and growth and you accomplish that by opening up schedules, hiring more doctors, freeing more capacity, marketing, etc, in the emergency room you don't take that approach. You might do work to make better use of the capacity that you have, but our goal is not to have "THE BIGGEST EMERGENCY ROOM AROUND!" and "Treat the most emergency room patients!", that is not the goal. The goal is community need, sort of..."*
>
> Hospital XYZ Chief of Strategy

Secondly, clinical staffing at Hospital XYZ follows a salaried model which was said to exacerbate an existing shift mentality in emergency services (i.e. ED physicians don't keep ongoing care delivery oversight and/or relationship with patients and leave at the

end of each shift). In other words, leadership thought that additional throughput could be attained with the same level of ED resources.

> *"We track ED physician productivity by the number of encounters per FTE. People work by the hour, they do their time, and then go home. They are salaried and don't have the incentive to do more. ED and anesthesia are similar in that they do shift work. You work what you have to while you are there, but when you leave you are no longer responsible. You don't have a patient panel"*
>
> Hospital XYZ Chief of Strategy

Finally, leadership mentioned its plans to empower the ED patient so that he or she could advance their own care through technology such as self-check in kiosks and vital signs monitoring.

> *"We want to try to get the patient to do as much work... let me change that... we want to empower our patients. [...] if you took the same technology and while the patient was in the waiting room they could basically have their blood pressure, pulse, temperature taken, by themselves while they sit there and fill out a form and have that electronically done, and a nurse did not have to do it when they came in, it would save an incredible amount of money."*
>
> Hospital XYZ COO

Additionally, a general word of caution was given such that research efforts remained non-biased to ED needs.

> *"[avoid] the prejudice of how everybody thinks the ER should take care of patients. So as you interview nurses and the staff there, all they are going to say is how they can make their little world better. That defeats our purpose."*
>
> Hospital XYZ COO

7.3 *Emergency Department Analysis*

The data collection and analysis of the ED took place over several months and entailed three main phases. The first phase was mainly concerned with building an initial understanding of operations through a three hour walkthrough and as many as ten ED onsite visits on different days of the week and at different hours of the day, which were ultimately translated into a Value Stream Map (VSM). The second phase consisted of eight individual interviews with different clinical staff, four of which were with ED physicians who allowed for audio recording. The third phase consisted of a quantitative analysis of patient data extracted from the ED's electronic medical record (EMR), as well as other IT systems, and during which the results of the previous two phases were leveraged and cross referenced. What follows is a description of each phase along with their respective key findings.

7.3.1 1st ED Phase: Walkthroughs, observations, and VSM

Visits to the ED took place at different times of day, week, and months, so as to provide for a more representative picture of underlying operations. Two things were immediately apparent in this longitudinal approach. Firstly, patient volume seemed to vary with the time of day and day of the week. Secondly, both clinical (i.e. physicians and nurses) and clerical staff (e.g. supply technicians) exhibited different demeanor at different data sampling periods. On the day of our first visit to the ED, we met with an ED Charge Nurse[82] in the hospital's main lobby and she walked us through a series of winding hallways, and two elevator shafts, until we finally made our way to the ED. Upon arriving in the ED, patient overcrowding was evident in a waiting area filled with patients as well as in the number of patients overflowing into hallways on stretches (i.e. if all ED beds are occupied, then patients need to be placed on stretches in the hallway, thus indicating that overcrowding was taking place; additionally, the ED waiting area was also full).

[82] Charge Nurses are more senior nurses who have the responsibility of overseeing patient flow for a specific service unit (e.g. emergency department). An ED Charge Nurse has the oversight of bed and staff availability in the ED and also helps coordinate the flow of patients that need to be admitted to the hospital.

Figure 7-2 and Figure 7-3 provide for a simplified VSM of the ED. The initial intent was not to derive a very detailed process map with rigorous cycle times but rather to identify the key processes, information systems, shared resources, and points of interaction in terms of inflow and outflow to and from the ED. The following is a description of these key elements:

Patient Arrival Modes: A patient may arrive to the ED via three different ways. He or she may be a walk-in which means that they arrived using their own means of transportation, potentially coming from home, or their primary care physician's office, or an onsite clinic. Alternatively they may arrive in an ambulance either for having been involved in an accident where someone dialed 911, or as a direct transfer from another hospital's ED. Finally a patient may also be transferred from a hospital's non-ED service which would entail being transferred to the homologous service at Hospital XYZ (e.g. an intensive care unit (ICU) patient from an external hospital is transferred to Hospital XYZ's ICU, but uses the ED as a point-of-entry).

Walk-in Patient Acuity Level: Upon arrival walk-in patients are immediately visually assessed by a nurse to determine if they are a level 1 acuity severity. The acuity severity scale ranges from 1 to 5. A level 1 patient is the most severe and consists of a trauma patient who needs immediate attention so as to preserve life and avoid loss of any potentially endangered limb, and is thus immediately placed in an ED bed located in a room or on a stretcher in a hallway. Levels 4 and 5 are considered minor injury patients, whereas levels 2 and 3 although in a more serious condition, are nonetheless in a stable enough condition and also remain in the ED waiting area while waiting to check-in[83].

[83] For a sample listing of patient chief complaints associated to each acuity level please refer to Appendix IV(i)

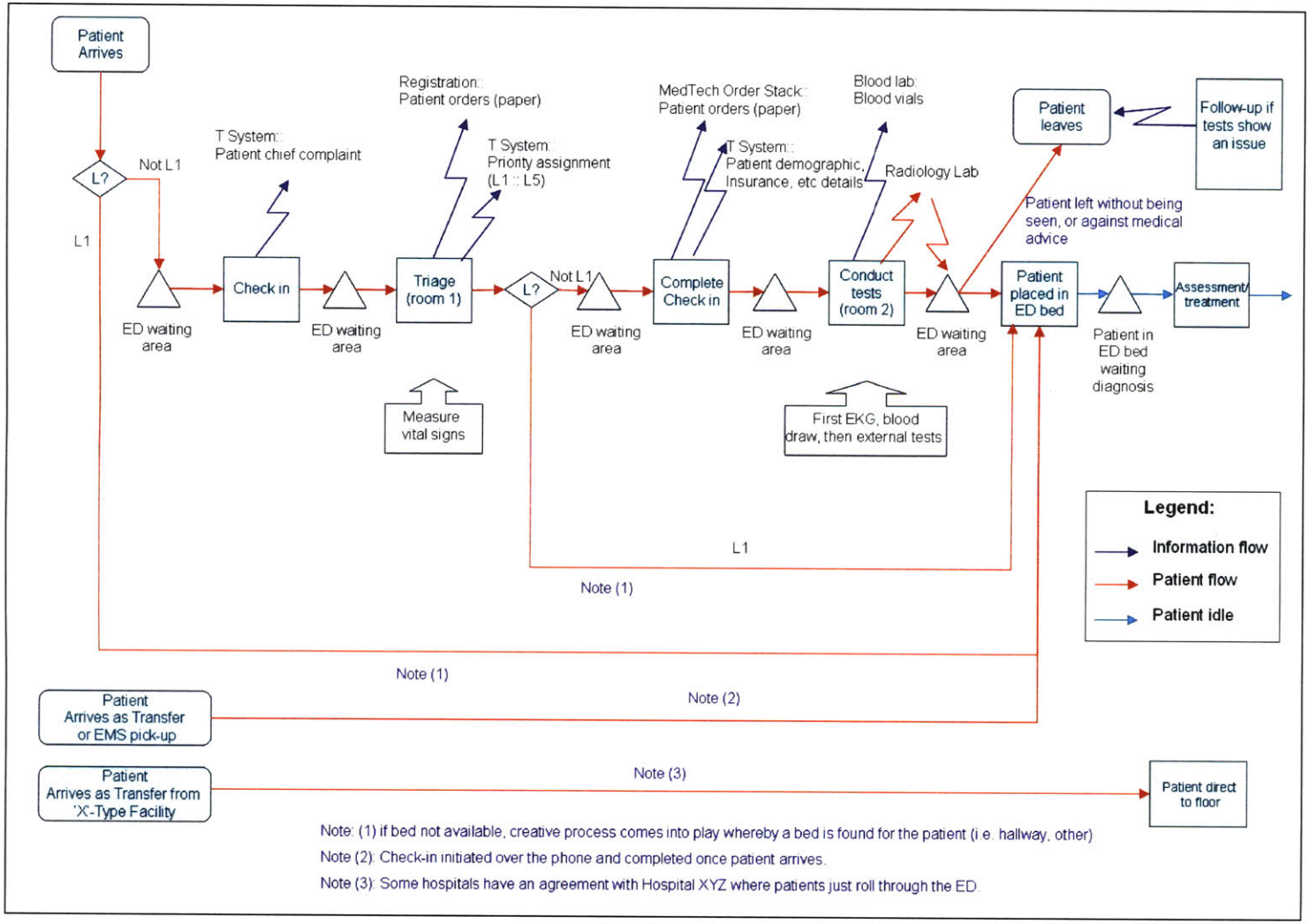

Figure 7-2: Hospital XYZ ED Value Stream Map (1 of 2)

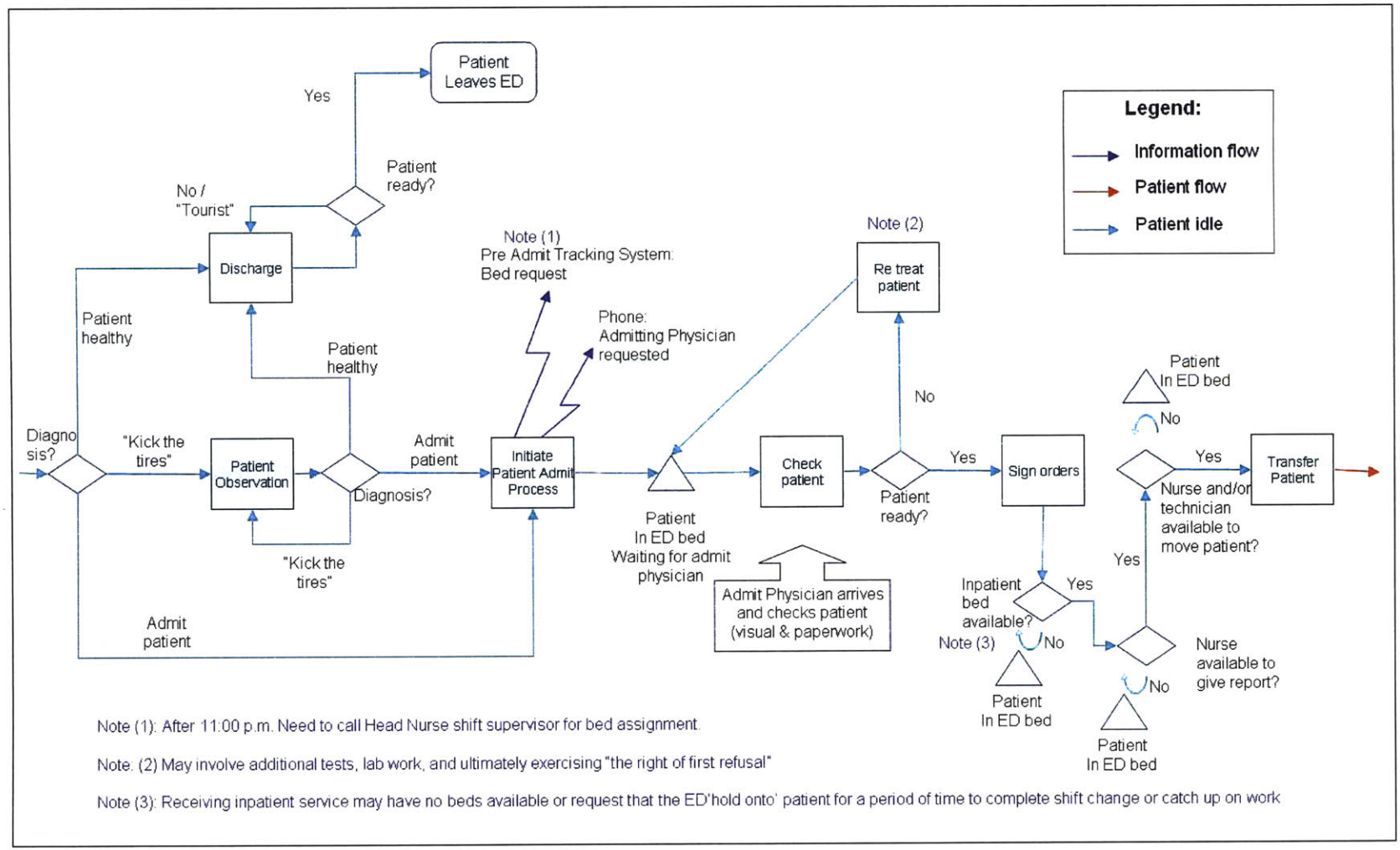

Figure 7-3: Hospital XYZ ED Value Stream Map (2 of 2)

ED Hours of Operation: The ED is operational 24 hours a day however the number of available staffed beds varies depending on the time of day. From 10am to 10pm there are a total of 22 staffed beds, where 18 of them are considered "Main ED" and the remaining four are considered "Minor ED"[84]. From 10pm to 10am the "Minor ED" is closed thus the ED bed availability is reduced to 18 beds. The concept behind the "Minor ED" is to allow for patients who have minor injuries (e.g. acuity levels 4 and 5) to be seen faster and in a room where there is less capital investment (e.g. equipment, raw material, etc) and less labor (i.e. nurse to patient ratios are lower in the "Minor ED" than in the "Main ED"). Additionally, by increasing the throughput of minor injuries the availability of the waiting area is increased.

Patient Check-In: An ED nurse, together with two ED clerks, operates the patient check-in terminals where important patient information is captured. The patient is asked for the reason prompting their visit (i.e. "Chief Complaint") as well as their name and date of birth. This information is inserted into the ED's specific system called "T-System", which is proprietary software that only runs in the ED and is mostly isolated from other software applications that exist in the hospital. Finally, the check-in process is also an opportunity to assess whether or not the patient's health has deteriorated into a level 1, and if so the check-in nurse would proceed with finding them an available bed or stretcher. Additionally, the check-in process consists of a quick way of collecting the minimum amount of information necessary to insert the patient into the system and allow for subsequent processes to begin.

Patient Triage: Triage takes place in a designated room and is conducted by a nurse practitioner (NP)[85]. When available the NP nurse checks the T-System patient log to see who is the next patient awaiting to be called, and she also determines what their Chief Complaint is. Next she calls them from the waiting room, measures their vital signs, takes a brief medical history, lists known allergies and medicine, asks screening questions for domestic violence, assigns them their acuity level, and inserts their acuity level into the

[84] Also known as "Fast Track" in the healthcare literature.
[85] Nurse Practitioners have additional training which allows them to operate different equipment and/or patient orders (e.g. drugs, blood tests, x-rays, etc).

T-System. Once again, if the patient acuity level is 1, the patient is ideally immediately placed in an ED bed or on a stretcher, otherwise he or she returns to the waiting are. Finally, the triage nurse begins the patient's paper medical chart where most of the information that was captured while triaging the patient is inserted. The paper medical chart will then be used in concluding the patient check-in process as well as over the course of the patient's visit to Hospital XYZ. Additionally the nurse will write patient orders (on paper) which will then be used in the "Conduct Patient Tests" subsequent process.

Patient Check-In Completion: Having gone through triage, and waited in the ED waiting area, the patient is then called by the ED check-in staff to complete their registration. The ED clerk confirms the patient's name and date of birth, and then collects their address, contact information, social security number, insurance information, and next of kin information. The information collected is immediately inserted into the T-System and added to the MediTech Order Stack for later processing. The MediTech is a software platform used throughout Hospital XYZ and its main purpose is to allow for charge capture that is later translated into specific billing codes associated with each insurance claim. Furthermore, it captures both patient and treatment information required by law. Notably the T-System and MediTech software aren't integrated and require duplicate human data insertion effort which may or not occur in simultaneous fashion, and thus the existence of a "MediTech Order Stack". Once the registration process is complete the patient returns to the ED waiting area.

Conduct Patient Tests: Having completed the check-in registration process, and waited in the ED waiting area, the patient is then called by a registered nurse (RN) to conduct tests in a designated room as per any patient orders that were written during triage. ED onsite tests may include blood drawing for subsequent analysis in Hospital XYZ's laboratory, or a first *Elektrokardiogramm* (EKG). If an x-ray (i.e. imaging) is required then either a nurse or an ED technician accompanies the patient to radiology and once the patient is ready they return to collect them and place them back in the ED waiting area. Notably the laboratory and radiology are shared hospital resources which service the ED,

the operating rooms (ORs), the inpatient units (i.e. inpatient bed areas), and clinics (primary and specialist). All service requests issued by the ED are assigned a *stat* order status which means that they have highest priority and need to be taken care of first. The interaction between the ED and the laboratory and radiology is made possible via two different systems:

- First, ED staff place laboratory orders in an old separate system which is cumbersome to operate. For instance, if a patient requires more than one blood test (which is often the case) the nurse needs to login, insert order, print order, and logout from the ordering system as many times as laboratory tests are necessary for each individual patient. The laboratory order printout is then placed in a plastic carrier together with the patient specimen (e.g. blood vial, tissue sample, etc) and sent over to the laboratory via a pneumatic tube. Once the laboratory test is done and inserted into the laboratory's own system, the test result is inserted automatically into the T-System and a visual signal is placed next to the specific patient thus allowing for the ED nurse to know that the laboratory result is ready.
- Second, ED staff writes radiology orders in paper format and these orders are carried by whoever is accompanying the patient to radiology and then subsequently given to either an imaging clerk or an available technician operating the imaging equipment. Once the radiology image is done it is automatically inserted into radiology's own system, and a visual signal is also automatically placed next to the patient name in the T-System. Once an ED nurse notices that imaging results are ready for a given patient, either the nurse or an ED technician proceeds to collect the patient from radiology and place them in the ED waiting area once again. The imaging results themselves can be retrieved in a separate system accessible in the ED by using the specific patient record number (i.e. one cannot simply click on the T-System and automatically open the imaging results).

Patient Left-Without-Being-Seen or Against Medical Advice: In the course of waiting for an ED bed and hence waiting to be seen by an ED physician, the patient may decide to leave at any of the waiting times between core processes. The likelihood of patients leaving increases as they find themselves waiting for longer periods of time (i.e. after

going through triage, completing registration, and procuring tests). The immediate implication of a patient leaving without being seen is that the ED is then responsible to contact them or their next of kin should any impending test results turn out to require urgent action.

Patient Placed in ED bed: In reality this process should read "Patient Placed in ED bed *or hallway stretcher*" as a result of the patient overcrowding in the ED. As previously noted, a patient will have been placed as soon as possible on an ED bed or stretcher if he or she was assessed as a level 1 acuity patient. Otherwise, patients are only placed in an ED bed/stretcher once they have undergone preliminary tests ordered during triage. The ED Charge Nurse has the responsibility of identifying a bed that has become available and has already been cleaned so that it may be assigned to a patient waiting in the ED. Notably the T-System has the capability of indicating whether an ED bed is available or not but the Charge Nurse prefers to keep visual tracking of bed availability since bed availability is dependant on it being clean, and such is in turn dependant on house keeping signaling that a bed has indeed been clean, which apparently doesn't always happen. However, it was equally true that upon different visits it occurred that patients were waiting in the ED waiting area and a clean bed was available and signaled as such in the T-System but the Charge Nurse wasn't aware of this as she was busy managing communications with inpatient units.

Patient Assessment and Treatment: Once placed in an ED bed the patient is seen by an available ED physician who proceeds to examine them. In the case of level 1 acuity patients, teams of physicians and nurses focus on stabilizing the patient and on avoiding the loss of limb while treating visible injuries. The remaining patients undergo an examination which may vary considerably depending on what their chief complaint was. The physician may assess a specific region of the body (e.g. a knee injured in a fall) or conduct a complete head to toe examination to determine a non-visible source of discomfort, and this variation entails a different amount of time to examine the patient and to subsequently treat them. At the end of the assessment the physician may immediately administer a treatment and diagnose the patient in a healthy enough

condition to be discharged and sent home or to a different type of healthcare provider (e.g. hospice, rehabilitation center, etc). Alternatively, the physician may decide to keep the patient in the ED under observation (i.e. the physicians describe it as "kick the tires" like one would do to a car in an auto-shop) so that the additional time allows for the treatment to take effect or for additional symptoms to reveal themselves in order to further treat the patient. Finally, the physician may make the decision that the patient needs to be admitted to the hospital to a given medical or surgical specialty in order to have sufficient and adequate care before being leaving the hospital. If a patient is kept in observation, upon reexamination by the physician, he or she may once again be discharged, or remain in observation, or trigger an admit process. All the while patient assessment and designated treatments are being recorded on the patient's medical chart. Notably, nurses have the responsibility of inserting into the T-System the exact time when an ED physician begins his or her assessment.

Patient Discharge (going home or to another provider): A patient discharge may be as simple as the patient getting ready (e.g. putting clothes on) or it may involve a nurse case manager coordinating care with external healthcare providers so that the patient may pursue further treatment. Delays are introduced into the discharge process when the patient doesn't have a means of transportation to leave the ED (e.g. the patient is unable to operate a vehicle and their family isn't readily available to pick them up) and thus unnecessarily continues to occupy an ED bed[86]. A different delay may be introduced in trying to locate an available external provider or in completing a hand-off process with the available external provider. In an extreme case patients who are healthy to be discharge may be admitted to general internal medicine as inpatients or otherwise remain overnight in the ED (most likely on a stretcher in a hallway). Finally, there may be situations where the patients themselves refuse to leave the ED even though they have been considered healthy enough to do so. Such patients are labeled as "Tourists" by the nursing staff.

[86] Hospital XYZ is legally responsible for the patient until they physically leave the ED, and since they don't have an observation unit (i.e. stable discharged patients are supervised by a minimum amount of staff) the patients need to remain occupying an ED bed.

Initiate Patient Admissions Process and Transfer: Once an ED physician makes the decision that a patient needs to be admitted to a given inpatient specialty, a series of sub-processes are triggered before a patient finally occupies his or her designated inpatient bed. These sub-processes involve communication between the ED, the requested medical or surgical specialty, the inpatient service units, and the hospital bed admission board. These stakeholders typically exchange information over a separate "Pre Admit Bed Tracking System", together with phone communication, beeper notifications, face-to-face reporting, and eventually the patient's medical chart. However as evident in the series of interviews and observations conducted, different physicians and nurses follow different practices whilst executing the admissions process.

For the sake of readability what follows is a simplified version of the admissions process which varies significantly whether the patient is being admitted to general internal medicine (GIM) versus any other medical or surgical specialty:

- **GIM admission:** If the ED physician wishes to admit a patient to GIM he himself may write the necessary patient orders in order to move the patient from the ED to the designated inpatient service unit whenever a bed becomes available and an internal medicine medical resident and/or attending is available to receive the patient handoff. Additionally the ED physician may request that the ED Charge Nurse immediately start securing a bed in GIM by contacting the hospital bed admission board. The admissions board is responsible for managing bed admissions throughout the whole hospital, and it does so by coordinating with each inpatient service unit and the ED using MediTech (i.e. inpatient system), beepers, and phone communication. Also concurrently, as soon as the ED physician writes the patient orders, an internal medicine resident may go to the ED to check the patient and receive handoff. Once the internal medicine resident receives the handoff what follows is a verbal report over the phone between the ED nurse who oversaw the patient's care and the inpatient nurse who will be caring for that same patient. Finally, an ED technician or ED nurse moves the patient from the ED to a GIM bed, and upon departure from the ED, the ED clerical staff is notified and inserts that information into the T-System.

- **Other type of admission:** If the ED physician wishes to admit a patient to another specialty (e.g. cardiology) then he or she must first seek approval from that specialty's medical resident, fellow, and/or attending, and these in turn ultimately write the patient orders in order to move the patient to the designated inpatient service unit. Additionally, the decision to admit may be delayed as the inpatient specialty physician may request further tests to be performed, and/or further treatments be administered to further stabilize the patient, or ultimately exercise his or her "right of first refusal"[87]. Theoretically, the ED is only allowed to contact the hospital bed admission board once the designated specialty accepts the admission. As before, the admissions board is responsible for managing bed admissions throughout the whole hospital, and it does so by coordinating with each inpatient service unit and the ED using MediTech (i.e. inpatient system), beepers, and phone communication. The remaining sub-processes are also the same as before (i.e. verbal nurse report, moving the patient[88], signaling patient ED discharge in T-System).

In both admission types, the ED physician is legally responsible for what happens to the patient until a patient handoff occurs (i.e. inpatient physician signs the patient orders). Similarly in both cases upon exiting the ED a T-System paper printout is made and placed on the patient's medical chart given that the T-System isn't integrated with the inpatient EMR (i.e. MediTech). Furthermore, each of the sub-processes described above may introduce significant delays into the admissions process as physicians may or not be immediately available to discuss a patient on the phone, or visit the patient in the ED, as is the case with nurses being available to give verbal report or to move the patient from the ED to the inpatient service unit. Finally, it is important to make a distinction between a patient being assigned a bed versus the patient being placed on a bed. Specifically, a patient may have been deemed admissible to a given inpatient service but because of the

[87] Some specialties have what is called "the right of first refusal", which essentially means that they may disagree with the ED's admission request and tell them to admit the patient elsewhere.
[88] Some specialties may require both a technician and a nurse in order to move a patient should he or she deteriorate in transit and require immediate assistance (e.g. chest compressions).

above mentioned delays or simply a lack of inpatient beds, he or she will remain in the ED as an admitted patient (i.e. also known as patient boarding).

7.3.2 2nd ED Phase: Interviews

The second phase of ED data collection and analysis consisted of eight individual interviews with different clinical staff, four of which were with ED physicians who allowed for audio recording[89]. Interviewees were selected randomly from each clinical staff pool (i.e. attending physicians, medical residents, and nurses) and the interviews themselves took place in the ED so as to be as convenient as possible for the interviewees to respond to an emergent patient situation. The interview process was informed both by the 1st ED Phase described in the previous section, as well as by MIT's emerging Nighitingale-Rhodes Enterprise Architecture Framework (NREAF) described in Chapter 3[90]. As such preliminary interview questions were asked pertaining to each of the NREAF views (i.e. External/Policy; Strategy; Process; Organization; Knowledge; Information; Service/Product) while leveraging specific observations from the 1st ED Phase and allowing for each interviewee to provide depth in those NREAF views which he or she found most relevant[91].

Figure 7-4 is an overview of our characterization of Hospital XYZ's ED sub-architecture which emerged from the data analysis presented in the next subsections. This characterization concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the ED) as well as enterprise level (i.e. pertaining to Hospital XYZ as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e.

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[89] The procedural steps underlying the qualitative data collection and analysis that follows are described in greater detail in Chapter 5.

[90] See section 3.4.3.

[91] The interviewees themselves were unaware of the NREAF while responding to questions, but subsequent analysis adopted each of the EAF views in interpreting phenomena of interest. Notably the coding of phenomena of interest as presented here already reflects the final coding resulting from the series of coding iterations within and across each case embedded unit (i.e. ED, Clinical Support Services, Administrative Support Services, Senior Leadership, and Inpatient Service Units), as well as with Chapter 8's Hospital ABC in-depth case study. Please refer to section 7.7.2 for our resulting enriched version of the NREAF. We recommend the reader to acquaint himself or herself with section 7.7.2 to better grasp the analysis and findings pertaining to each embedded unit.

leverages the enriched NREA framework discussed at the end of this Chapter 7[92]). The circle placement of the EA Views is meant to illustrate that they are interconnected.[93]

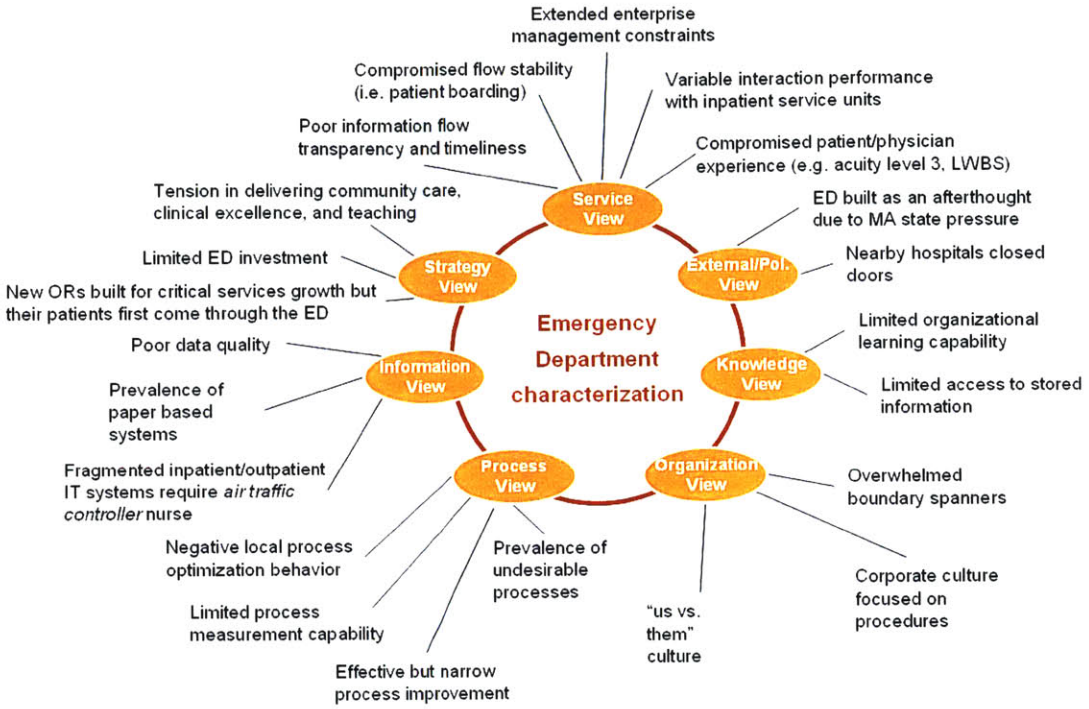


Figure 7-4: Hospital XYZ Emergency Department sub-architecture characterization

7.3.2.1 ED External / Policy View

"*Policy/External: The external regulatory, political and societal environments in which the enterprise operates*" (Nightingale 2009)

The beginnings of Hospital XYZ were described as a multispecialty physician group practice which used to operate in the center of a major city and decided to build its own hospital rather than continue to refer patients to nearby hospitals. The decision to locate the hospital 30 miles from the city center was deemed a brilliant one as it greatly improved access and allowed them to provide a teaching and specialty care service in a community where there were only cottage hospitals (i.e. small community hospitals). As part of the negotiation with the surrounding community Hospital XYZ had to change its

[92] See section 7.7.2.

[93] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 7.3.3.2 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions.

original construction plans and include an ED, which was considered as an after thought decision that ultimately hindered patient flow.

> *"the layout of this building is not efficient. This tells you how much of an afterthought the ED was for Hospital XYZ. It was demanded by the town of [omitted] that [Hospital XYZ] have an ED otherwise they would not permit the building to occur. So the ED was not part of the original design"*
>
> Hospital XYZ ED Charge Nurse

More recently the large city hospitals began expanding their geographic reach and as a result Hospital XYZ is said to feel additional pressure to continue to grow at the same rate as before. Additionally, Hospital XYZ's own expansion plans in terms of its critical services offering were said to specifically follow those for which external stakeholders were willing to pay more and not necessarily those which the hospital itself needed more in order to provide better care.

> *"A couple of years ago when they were building out the critical care services, more operating rooms, more cat labs, when they were spending very large sums of money on services that were clearly seen as generating income, the buzzword was "financial credential". That if you were going to look at departments that had needs, the needs that you were going to address with investment, were the needs that were going to return the largest financial return on the investment, because hospitals operate in a very narrow margin. So there was a compelling need to spend limited resources in a financial effectiveness way where you could guarantee the maximum return on your investment. Unfortunately what would qualified as need was more what was seen producing revenue, than what was seen as producing perhaps more effective care, or better care."*
>
> Hospital XYZ ED Physician 4

An additional factor considered of importance in describing the ED context was that of the evolution of medicine itself and the aging of the population which ultimately impact the provision of care. Whereas 20 years ago one would have to admit a patient to the hospital for a three or four day stay just to get the diagnosis and treatment done, today

drugs are available that allow for physicians to have a significant effect in a short amount of time. Conversely, another effect of drugs is that they have changed the definition of urgent care, where the previous 20 to 30 minute response window has been enlarged to as much as two to three hours. Additionally, over time nurses have been better able to support physicians by collecting patient information (i.e. chief complaint, vital signs, current medications, and past medical history) even before the physician has seen the patient. Such support helps considerably as the ED is considered a fast paced environment which generally follows a problem focused approach. However as the care delivery capability increased so have the expectations of individual patients.

"... but the more we can do, the more we are expected to do!"

Hospital XYZ ED Physician 3

Finally, several references were made concerning the regulatory requirements of a physician's (i.e. attending) responsibility towards a patient and how it in turn may affect patient flow. If an inpatient specialty resident and/or physician aren't available to write orders for a patient who is in a stable condition, and even if an inpatient bed has been assigned to that patient, then the patient must remain in the ED until someone is available to receive the patient handoff and thus ensure the continuity of care.

"If a resident screws up, their attending is ultimately responsible because you didn't adequately supervise the resident when he was treating patients."

Hospital XYZ ED Physician 2

"A resident is always an agent of the attending. A resident is a licensed physician and they exercise various degrees of independence and autonomy. I am legally responsible for what the residents are writing and ultimately for that patient."

Hospital XYZ ED Physician 1

7.3.2.2 ED Strategy View

"*Strategic goals, vision and direction of the enterprise including the business model; enterprise metrics and objectives*" (Nightingale 2009)

The definition of strategic goals, vision, and direction of the enterprise traditionally lie with senior leadership in organizations, and indeed these were included also to that effect in subsequent sections of Hospital XYZ's in-depth case. However, the ED's interpretation and receptivity of Hospital XYZ's overarching strategy emerged as relevant phenomena in describing organizational behavior, as evidenced in the following analysis.

> *"Our obligation [in the ED] is to identify high risk illnesses and diseases. To do it in a timely fashion and to institute life and limb saving and preserving. Emergency departments become much more than that. It should say emergency care, it should say convenience care, and primary care."*
>
> Hospital XYZ ED Physician 2

As noted in the previous section, ED physicians generally felt that senior leadership at Hospital XYZ was tailoring its strategy to the most revenue generating services as determined by what external stakeholders were willing to pay. As such, ED physicians fundamentally disagreed with Hospital XYZ's strategy which they felt neglected the ED's operation and consequently the hospital's responsibility towards the surrounding community.

To begin with, the ED physicians noted that senior leadership narrowly focused on expanding specific service lines (e.g. surgical care services, cardiothoracic services, cardiovascular center, etc) and in doing so invested in additional operating rooms but didn't take into consideration the impact that such a growth strategy would have on the ED. Moreover, the ED experienced a significant increase in patients requiring emergency care pertaining to the newly expanded service lines (e.g. heart attack) which necessarily implied dedicating limited resources towards them and keeping less acute patients waiting for attention for several hours (e.g. acuity level 3 patients).
Furthermore, several of the ED physicians alluded to a corporate culture that focused on surgical procedures and minimized or even ignored the contribution that the ED had towards sustaining overall operations. Not only that, senior leadership broadcasted its

successes in the expanded service lines, which only reinforced the neglect felt by the ED. However the implications of the procedure oriented corporate culture weren't only felt at the strategy and investment planning levels, but also at a more fundamental operational level in that surgical specialties were said to more often than not exercise their "right of first refusal" and in doing so tell the ED to admit to GIM instead.

"Most hospitals see their emergency department as their interface with the community. That has been absent here. We have essentially operated the same physical plant for the last two decades, just minor revisions and minor expansions. There has not been an emphasis [on] emergency care that is community friendly. You might ask why? The answer is cultural more than anything else. It is financial. It is not seen that investing in the emergency department generates more money"

Hospital XYZ ED Physician 4

"Usually the specialty services have a default position of "admit to medicine" and exercise their right of first refusal."

Hospital XYZ ED Physician 2

"Medicine is the default service. If nobody else wants the patient they go to medicine. A specialty service can say "I don't want that patient on my service, admit them to general medicine". Medicine takes the multiple hits and has the big load."

Hospital XYZ ED Physician 1

"One of the things you need to understand is the corporate culture and that in great part drives behaviors, and in great part affects how people perform. I don't think it will take you too many visits here with stretches stacked up in the hallways and patients waiting for six hours to be seen, to know that this a model flaw. The hospital has created a tremendous need for this critical care by extending all its critical care services, surgical services, cardiothoracic services, becoming a cardio vascular center, we do interventional angioplasty, we're a stroke service, we're a trauma service, and all these bring critical care patients, and they all come through the emergency department. And that this emergency department has not been redesigned for 15 or 20 years."

Hospital XYZ ED Physician 1

"From the perspective of the emergency department when we were looking at where the money was going... knowing that there is a tremendous need in this department for expansion and improvement of operating systems... that money was not being spent here... the administration actually came to us trumpeting the successes of the expansion of the other services, and had little appreciation for the impact that that had on this department... that by increasing all these critical care draws, all of which still needed to go through the emergency department, not to address the rate limiting factor, to operate with complete disregard for the rate limiting factor, it seemed at best misguided and was ludicrous."

Hospital XYZ ED Physician 4

"They have gone out and they have marketed all their special services. If you are having a heart attack this is where you want to come, we are in the top 100 cardiovascular centers of excellence in the country, so when you have your heart attack this is where you want to come. If you are clutching your chest at home saying "I am having chest pain", and the medics did your cardiogram, and you had changes on your cardiogram that showed you had an acute heart attack, your passage from door to angioplasty is measured, and it is measured by a national standard, and that standard has become more rigorous, and there has been great attention and effort paid to facilitating the passage of those patients from the point of entry to the point of the delivery of care. Same is true for stroke. Same is true for other critical care patients, sepsis for instance... but that uses a finite resource. If a patient comes through with his MI, patients who are here with their shortness of breath, their pneumonias, their abdominal pain, don't get seen! This is the narrowest point in the delivery of services in the hospital system."

Hospital XYZ ED Physician 1

7.3.2.3 ED Service View

"Services(s) delivered and or supplied by the enterprise, including in support of products." (Nightingale 2009)

The ED's inflow and outflow interactions are part of the overall service architecture of Hospital XYZ, as are the ED's own internal processes. Events that take place either upstream or downstream may have significant implications in the service architecture overall. Some of these implications have already been noted in previous sections and are summarized below:

- Delay in discharging patients due to unavailable follow-on care providers
- Delay in discharging patients due to family members not being available to retrieve patients
- Narrow strategy focused on increasing ORs for high revenue generating specialties neglected the adverse impact and hence the necessary investment in the ED
- Focus on patients requiring urgent inpatient specialty care adversely impacting the care of more routine services required by the surrounding community.

In addition to enabling the procedure focused strategy of Hospital XYZ, the ED was also said to be used inadequately by both clinics and inpatient services which took advantage of its ability to process and attain test results faster.

> *"So when you are out here dealing with emergency patients, you are dealing with patients that are overflowing from other services from the hospital for a variety of reasons"*
>
> Hospital XYZ ED Physician 2

For instance, rather than having the patient sent from the clinic to a series of ancillary service visits, the clinic specialist would have the patient sent to the ED in order to have all tests processed in a centralized and expedited manner. Technically, such a patient could be administered such tests in a non-urgent care environment. Similarly, a patient requiring admission from a specialist clinic is sent to the ED rather than being processed as a direct admit to an inpatient service unit, because the ED theoretically does so more efficiently. Another example is in the case of patients admitted through the ED who remain longer in the ED in order to attain test results required by an inpatient specialty admitting physician, who would otherwise have to oversee the test administration (e.g. blood draw; tissue collection; accompanying the patient to radiology) and subject him/herself to a non-stat test processing (i.e. urgent care tests are given precedence over less urgent tests).

> *"... there has been the assumption that the emergency department will operate without initial investment. There is the assumption that the emergency department will operate efficiently,*

that we can get evaluations done faster than in an inpatient service and certainly than on an outpatient basis, so that it is convenient and expedious for the patient to use the emergency department. But there has also been an assumption that you can expand the demand and that demand will be incrementally met by the department. That it has the capacity to respond to all demand. And that is unrealistic."

Hospital XYZ ED Physician 4

"We also have patients that we admit where the decision to admit has been made in the office. If I am an internist and see a patient that has chest pain discomfort and I know that patient needs to be admitted, typically that patient gets sent to the emergency department to stage his admission because we do it efficiently. But that patient legitimately could be sent to the floor directly [from the office]. That is a cultural issue"

Hospital XYZ ED Physician 2

The compounding effect of these cultural issues together with the procedure focused strategy has been an ED struggling to sustain patient throughput in a manner that is equitable and caters to both the specialized care and primary emergency care needs of the surrounding community. Already one could begin to appreciate that the ED's overcrowding wasn't the sole responsibility of those working in the ED but rather a combination of factors from the EA Views analyzed thus far (i.e. External/Policy, Strategy, and Strategy). However, it wouldn't be accurate to say that the ED has been completely neglected as there have indeed been efforts to improve the system. The problem is that the improvement initiatives themselves have been equally narrow and only focused inside the ED whilst adopting quick fixes rather than fundamentally redesigning the service architecture within and beyond the ED.

"There have been efforts to improve the system but the impact has been very limited within the hospital at large. The issue of admission, of getting orders written, has been addressed repeatedly for many years, and there have been changes that have occurred, increased number of teams, attending moonlighters, is it currently adequate? No! Patients wait in the hallways because there are no beds for them to be on. It is a small department. It gets smaller if beds are occupied. If you are obligated to maintain a certain flow, even of non critical patients, if you want to target a certain flow rate, and I have now narrowed the diameter of

the tube but can't increase the velocity, what happens? You have a dam effect. The holdovers effectively reduce the size of this department, and we can have at times upwards of 15 holds in the emergency department and we have 17 beds. So what you have are multiple patients in the hallway."

Hospital XYZ ED Physician 1

"The questions that you are asking are issues that many of us have dealt with over and over and over again for many years. I have personally been on three process redesign committees in the last 12 years, and the process has not been redesigned."

Hospital XYZ ED Physician 4

Interestingly although some ED physicians recognized the importance of considering other entities and their respective impact in ED operations (i.e. thinking beyond the boundary of the ED), their proposed solution would be to either increase the size of the ED or the size of the inpatient service units. The intermediate solution of improving flow by other means wasn't a consideration thus existing overcrowding issues were mainly associated to capacity issues.

"Personally I just think that we could manage this department really well if we could get the admitted patients out. [...]Either the hospital gets bigger or we get bigger or I don't see us being able to handle the volume that is going to get even worse down the road."

Hospital XYZ ED Physician 3

Yet another example of an absent understanding of the service architecture became evident in the ED physician's description of how inpatient specialties were scheduled and how that in turn affected the ED flow. To begin with considerable variability was described in terms of the admission processes and available resources of each inpatient specialty. Depending on the time of day there is a different number of staff available and indeed their configuration also varies (e.g. clinical staff team composition). For instance, some specialties have an unwritten policy of not accepting ED patients during the first two hours of a shift changeover. Other services may also have an unwritten policy of

capping the number of admissions they receive during a given shift regardless of inpatient bed availability.

"you may have one admitting team, you may have two admitting teams, you may have an admitting resident, you may have an admitting night attending, it varies tremendously throughout the day when we look at the medical services which is where we admit the majority of the patients to the hospital. You may also have the situation where there may be 4, or 5, or 6, or 8 patients awaiting admission to a medical service which means that the medical service needs to see them in some capacity to write their admissions order"

Hospital XYZ ED Physician 1

"Usually around 7.30am they start answering their pages. But if the hospitalist [...] has several patients from the previous evening that he has to see. You know if I say that this patient is ready to be admitted, and the attending is still getting to the hospital and still has to see his existing patients on the floor, then my patient can be left sitting and waiting for 3 hour! And during the day the admitting team may have capped... they have taken all the admissions that they were going to take on their service for that day, so they may cap in the afternoon at 3 o'clock, and yet the next team might not be coming in until 6 o'clock, so they will take the name of the patient but when the six o'clock team or teams come in, there may be 8 patients who are waiting to be seen, and you may have not been able to get any orders written in the afternoon."

Hospital XYZ ED Physician 1

The end result is that care delivered in the ED is subpar to that which ED physicians would like. Sick patients find themselves waiting for an ED bed and if admitted they also have to wait for an inpatient bed. In turn ED physicians feel pressed to process the patient volume and are unable to build a connection with the patient beyond focusing on that which is absolutely necessary to prevent loss of life and limb.

"We are trying to deal with volume. I would like to spend 5 minutes interviewing the patient to get to know them personally, but we don't have the time to do that in the emergency department."

Hospital XYZ ED Physician 3

Granted the nature of emergency care is such that physicians need to respond quickly, and it may well be that trauma patients may even be unconscious and incapable of building any connection with clinical staff. However, the vast majority of patients isn't trauma patients (i.e. level 1 acuity) and could potentially benefit from an improved interpersonal connection. Avedis Donabedian, who has been referred to as one of the founders of the modern science of health care quality measurement (Romano and Mutter 2004), supported the view that technical care alone is insufficient in measuring the quality of care, and that the outcome of care indeed depends on the management of the interpersonal relationship between the patient and care givers:

> *"It is a vitally important element. Through the interpersonal exchange, the patient communicates information necessary for arriving at a diagnosis, as well as preferences necessary for selecting the most appropriate methods of care. Through this exchange, the physician provides information about the nature of the illness and its management and motivates the patient to active collaboration in care. Clearly, the interpersonal process is the vehicle by which technical care is implemented and on which its success depends. Therefore, the management of the interpersonal process is to a large degree tailored to the achievement of success in technical care"*(Donabedian 1988)

Notably there were inpatient specialties that deserved the caveat distinction by ED nurses and physicians alike in that they were quick to respond to the ED requests and thus helped improve flow (i.e. neurosurgery service and orthopedics service). However, at a higher level, the general perception of the ED clinical staff was that senior leadership didn't acknowledge the contribution that the ED had for the whole of Hospital XYZ, which was consistently evident in an absent understanding of the meaning and importance of the EA Service View.

> *"The administration doesn't credit the added value service that the emergency department allows for it to do the operations, you get to do the catherization, you get to do the angioplasty, you get to have the stroke patient."*
>
> Hospital XYZ ED Physician 4

7.3.2.4 ED Process View

> *"Core leadership, lifecycle and enabling processes by which the enterprise creates value for its stakeholders."* (Nightingale 2009)

In analyzing the ED from the previous three EA views of External/Policy, Strategy, and Service we have already identified key factors that have had a direct implication to the underlying Process View, as will be the case with the remaining EA views yet to be analyzed in subsequent sections. Some of the implications noted in previous sections are summarized below:

- Standards are absent on when patients should receive care in an ED environment. For instance, clinics optimize their own throughput by sending their patients to the ED instead of admitting them directly to the inpatient floors. Similarly, inpatient specialties request additional tests before admitting patients as the ED will process them in a more expedite fashion.
- Standards are absent on how and when patients are admitted to the different inpatient specialties. For instance, different specialties have different teams that vary in size and composition depending on the time of day which affects their own ability to care for their inpatients and ultimately impacts their admissions capability. Similarly, different specialties institute unwritten policies as to how many ED patients they will admit in a single shift irrespective of inpatient bed availability.
- All inpatient specialties other than GIM have the *right of first refusal* which enables them to reject an ED patient admission. Some specialties have the default position of consistently exercising this right and instructing the ED to admit to GIM instead.
- Process improvement initiatives have narrowly focused within the ED and have yet to redesign processes across the value stream (i.e. beyond the ED) as evidenced by the continued number of patients waiting in the hallways because enough beds aren't available for them. Improvement efforts were described as having had a very limited effect within the hospital at large.

Having analyzed the detailed descriptions from both nurses and physicians as to how they care for a patient in the ED and have him or her admitted as an inpatient, allowed us to further appreciate the considerable complexity inherent in their processes. Notably several of the process insights were already incorporated into the previously presented VSM. However, there are some process nuances which deserve further refinement in our analysis. To begin with different patients may require different patient orders (e.g. blood tests, imaging, drugs, etc) and present variable response times to the same treatment. As such, an ED physician assessment may focus on a specific body region (e.g. knee or an ankle) or require a more thorough examination from head to toe. Treating and diagnosing are two activities that go hand-in-hand in an emergency medicine context as the ED physician tries to quickly isolate a problem by studying a patient's response to a particular drug and/or has to allow for additional observation time (i.e. *kick the tires*) in order for additional symptoms to present themselves.

> *"In emergency medicine you are often treating with diagnosing. So even at the patient bedside we may be giving them medication depending on how sick they are, and then reassessing based on the reaction to those interventions. Then there is usually a lag time anywhere from half an hour to three hours depending on what tests I have ordered, if I have ordered blood tests I should have those results within half an hour and that will be fine, if I need a CAT scan [the] patient will have to drink for an hour, get their CAT scan, so it can take up to another hour to get their results, and then I need to do my own review and potentially confirm my thoughts with the radiologists. So the lag times can very a lot."*
>
> Hospital XYZ ED Physician 3

> *"I knew that the patient needed to be admitted when I left the examination room, but I don't have a diagnosis yet, so I don't know where she needs to be admitted to."*
>
> Hospital XYZ ED Physician 2

Another factor concerning complexity introduced by specific patient characteristics is that of patient gender which amid an overcrowded ED that relies on stretches places additional challenges for physicians to care for those patients. Succinctly, a male patient

offers greater flexibility as to what can be examined in the middle of a hallway as opposed to a female patient.

> *"So what you have are multiple patients in the hallway, you are seeing patients in the hallway, since you are a man I can do a chest and abdominal examination in the hallway, but if you were a woman I couldn't do that examination in the hallway."*
>
> Hospital XYZ ED Physician 1

Furthermore, additional complexity is introduced in the process when we consider that Hospital XYZ is an academic medical center where as many as 30% of its physicians are interns and residents enrolled in a given specialty training. Surgical services in particular were said to be considerably more hierarchical because of ensuring quality of care while training new physicians. However, the undesirable effect of training is that it considerably hinders the flow of the ED. The following is a particularly rich description that illustrates how an ED patient that requires admission can remain as many as eight hours in the ED going through the admissions process of two different specialties:

> *"The medical service behaves differently than the surgical services. Surgical services have what I refer to as the right of first refusal, and they evaluate patients in a somewhat different process. Surgical services are much more hierarchical. For instance, I have a patient now that has a small bowl obstruction and I know this lady needs to be admitted. I have seen the patient, I have seen the x-ray, I knew the patient needed to be admitted half an hour ago when I looked at the films. I called up to the junior surgical resident, and he is probably not at this time going to be terribly busy because he hasn't been given too many other admissions, but he may be off at the operating room, or he may be taking care of his inpatient services, but the junior resident will come and see my patient and do an assessment. The junior resident will then acquire or wait until he has data that he thinks is adequate so that he can present to the senior resident. The senior resident will then see the patient. The senior resident will then decide whether or not they need to contact a fellow who is a post residency graduate in a specialty service. The fellow may then come and see the patient. And then after the fellow has seen the patient they may decide whether the patient needs to go to the operating room, needs to be admitted to the surgical service, or whether they don't want to admit that patient but yet acknowledge a need for admission, at which point they may say: "we don't think this patient*

needs to be admitted to the colorectal service, admit them to medicine". So after 4 evaluations, emergency attending, junior resident, senior resident, fellow, discussion with the attending, the decision to be made is that the patient is not going to their service. Each time, each physician is obligated to give an assessment because he intellectually, academically, and professionally is responsible for the decision that he is trying to make. Now the surgical services work that way because it is good for their training in a way, but it is not good in terms of managing flow in the emergency department. I knew that this patient needed to be admitted an hour ago, and it may be an additional 3 hours until this patient to be seen by the necessary people to have them admitted to the surgical service, and it is quite possible that after they have seen this patient, they will decide that because she has an ovarian cancer and had chemotherapy and has multiple lesions that they don't admit the patient. Then you'll have to go to the medical service, who will call the medical resident who will then put the patient in their list of things to do. And you can do an 8 hour evaluation before you can get an owner that will admit the patient."

Hospital XYZ ED Physician 1

The admitting process and individual discretion exercised by different ED physicians is such that they described different processes in admitting their patients to either medicine or surgical inpatient services. All physicians were consistent in their description of admitting to general internal medicine in that they don't require an internal medicine resident's pre-approval of admission in order to request an inpatient bed. However, some physicians maintained this policy even when requesting admission to a surgical specialty, whereas other physicians refrained from doing so as they knew that the specialty could exercise their *right of first refusal.*

"If I want to admit to a surgical service I cannot immediately get the bed because I know that they have a right of refusal. So I can't [immediately] start the bed process with the surgical services."

Hospital XYZ ED Physician 1

"You can often make the decision of admitting a patient without any data. At that point you notify the charge nurse who is either in touch with the bed board that works during the day,

or the nursing supervisor during the evening, to get a bed assignment. We try to get a bed assignment even before we have an inpatient physician to write the admission order."

Hospital XYZ ED Physician 2

One of the cumulative effects of different stakeholders pursuing their non-standardized localized process optimizations (e.g. admitting physicians holding patients longer in the ED to attain quicker test results; clinics sending patients to the ED rather than admitting them directly to the inpatient service units; ED physicians requesting beds without inpatient attending approval) is that patients don't flow seamlessly and require constant intervention from the ED Charge Nurse to find ways to accommodate admitted patients inside the ED and have them eventually transferred to an inpatient service unit.

"My role is similar to the air traffic control at an airport where I try to bring in the patients, make sure that we have a bed ready and that the required services are available to serve the patient, and to do this while everything is moving and changing."

Hospital XYZ ED Charge Nurse

Finally, given the cumulative assertions that Hospital XYZ's senior leadership didn't recognize the ED's contribution, and although the ED wasn't responsible for process measurement activities, specific questions were asked as to what types of performance data they had access to. In general clinical staff was consistent in terms of their descriptions and use of quality metrics (e.g. patient falls, mortality, hospital readmissions, etc) as well as their assessment of operations as being poor given the continued visual evidence of patient overcrowding and difficult interactions with frustrated patients and family members. Notably, whereas detailed reports were referenced in terms of quality metrics, the same practice wasn't followed in terms of operational metrics (i.e. they simply relied on visual inspection of throughput). When asked about financial metrics the nurses and medical residents didn't express an interest or indeed knowledge of such metrics. Conversely, ED physicians were keen to see financial metrics pertaining to the ED and the inpatient services they referred to, but they said that they had been continuously denied access to such information.

We have asked for the financial data [on each of the services] and we have not had access to it. This gets into a discussion of institutional behavior rather than pragmatics of a scientific project. We got ourselves into a war because of what we chose to see and what we chose not to see. And this administration has chosen not to see a need in the emergency department.

Hospital XYZ ED Physician 4

7.3.2.5 ED Organization View

"The organizational structure of the enterprise as well as relationships, culture, behaviors and boundaries between individuals, teams and organizations." (Nightingale 2009)

As before, the analysis of the previous four EA views of External/Policy, Strategy, Service, and Process have allows us to identify key factors that also have a direct implication to the underlying Organization View. Some of the implications noted in previous sections are summarized below:

- ED tension towards hospital administrators: on various occasions observations were made regarding the dominant *corporate culture* of Hospital XYZ which wasn't necessarily aligned with the underlying culture of the ED. Examples included specific language used such as ED physicians being at war with hospital administrators and feeling underappreciated in terms of the ED's contribution to the remainder of Hospital XYZ. Specifically, from the ED's perspective the surgical procedure focused strategy sought by hospital administrators and welcomed by certain inpatient specialties prevents the ED from delivering on its mission of providing emergency and primary care services to the surrounding community.
- ED variable behavior towards inpatient specialties: clinical ED staff behavior towards inpatient specialties exhibited sharp distinctions depending on the inpatient specialty under consideration. Notably the neurosurgery and orthopedics services were said to be better to work with and they responded to ED requests in an adequate timeline and helped ED flow. Conversely other services such as cardiology were described in a much dimmer light considering their practice of consistently exercising their *right of first refusal*. Finally the GIM service was described sympathetically as overburdened as well and performing as best as possible given the circumstances.

- ED behavior towards outpatient clinic services: ED physicians noted that the outpatient clinics had the practice of sending them patients which could have been admitted directly to the inpatient floors but they elected to send them to the ED instead so as to not have to manage the admissions process themselves.
- Variable clinical hierarchies: certain inpatient specialties require additional hierarchical levels presumably to oversee the training of medical interns, residents and fellows. Other specialties such as GIM allow for medical residents to admit patients without intervention of senior residents or any higher ranked physicians.

The analysis of organizational culture and organizational origins are fundamental aspects in understanding enterprise behavior. Earlier in this chapter[94] we described Hospital XYZ's history and its institutional character as portrayed by senior leadership:

> *"Our character is specialized care and not to be a community hospital [...] the hospital is an extension of the group practice, as opposed to all the other places where the hospital existed and individual physician practices developed to support the hospital."*
>
> Hospital XYZ COO

Upon revisiting this particular description one is reminded of how the origins of Hospital XYZ, namely it being a physician led multispecialty group practice which built its own hospital, drove and still drives the previously described procedure focused strategy whilst minimizing its role as a community care provider.

> *"Our obligation is to identify high risk illnesses and diseases. To do it in a timely fashion and to institute life and limb saving and preserving. Emergency departments become much more than that. It should say emergency care, it should say convenience care, and primary care."*
>
> Hospital XYZ ED Physician 2

Clearly from the onset there is a cultural disconnect between the missions of senior leadership at Hospital XYZ and that of ED clinical staff who see themselves as the

[94] Please refer to section 7.1.

primary link with the surrounding community. Such a disconnect helps explain the negative views consistently expressed by the various ED physicians when describing and evaluating Hospital XYZ's strategy. The ED physicians emphasized that senior leadership specifically invested in high revenue generating services and neglected to invest in the ED in order to at least cope with the associated increased demand of trauma services related to those high revenue generating services.

> *"One of the things you need to understand is the corporate culture and that in great part drives behaviors, and in great part affects how people perform. I don't think it will take you too many visits here with stretches stacked up in the hallways and patients waiting for six hours to be seen, to know that this a model flaw. The hospital has created a tremendous need for this critical care by extending all its critical care services, surgical services, cardiothoracic services, becoming a cardio vascular center, we do interventional angioplasty, we're a stroke service, we're a trauma service, and all these bring critical care patients, and they all come through the emergency department. And that this emergency department has not been redesigned for 15 or 20 years."*
>
> Hospital XYZ ED Physician 1

> *"From the perspective of the emergency department when we were looking at where the money was going... knowing that there is a tremendous need in this department for expansion and improvement of operating systems... that money was not being spent here... the administration actually came to us trumpeting the successes of the expansion of the other services, and had little appreciation for the impact that that had on this department... that by increasing all these critical care draws, all of which still needed to go through the emergency department, not to address the rate limiting factor, to operate with complete disregard for the rate limiting factor, it seemed at best misguided and was ludicrous."*
>
> Hospital XYZ ED Physician 4

Previously we described how technical care and the management of the interpersonal relationship between the patient and care givers are both important elements in assessing the quality of care. However, several ED clinical staff members alluded to their inability to engage patients from a *blank slate* to begin with and that in some cases patients were

even hostile towards them. Thus not only physicians were unable to engage with patients for prolonged periods of time due to patient overcrowding (i.e. they had pressure to see several patients), but the short time spent with patients was in itself of poor quality given that patients were upset. Nurses in particular expressed frustration as they felt powerless in the presence of external factors (i.e. admitted patients remaining in the ED) and spoke of a role disconnect in that they didn't feel satisfied in caring for less urgent patients (e.g. *I didn't train for this!*)

> *"If you spend enough time here you will get a sense that there is a very high level of frustration, and I think that extends through the staff and certainly involves the patients, in front of the patients. Most people don't like waiting 5 hours to be seen, especially if they have a real problem, and that creates a certain hostility as the initial introduction to your relationship. One of my initial challenges when I greet a patient is to align myself with you, and not apologize for it is not my delay, in other words I say "I'm sorry, this is unfortunate, I see this as a problem as well, but now that I am here, what can I help you with?". We have to work together in a patient-physician relationship. You start that relationship with that level of frustration and sometimes hostility. And unfortunately the nurses deal with that all along. While you are waiting for 6 hours you are not seeing me, you are seeing the nurses, and you are saying to them "why am I not being seen? why am I waiting for my x-ray? why am I waiting for my labs? why hasn't the doctor seen me? why is that patient being seen before me? six people have come after me and have already been seen, why is that? why aren't you telling me what is going on?". And even if the nurses speaks with them and explains all the delays, it still is not enough because we are a demand society. If you walk into MacDonald's and you wait longer than 3 minutes to get served that has been an unsuccessful visit, and that mentality extends to most service industry."*
>
> Hospital XYZ ED Physician 4

Finally, an additional organizational element consistently reflected across interviews was that of physician incentives and how these affected behaviors towards supporting (or not) patient flow. Interestingly, senior leadership[95] had also referred earlier to Hospital XYZ's incentive structure and suggested that the ED has a shift mentality which prevents it from

[95] Please refer to section 7.2

increasing patient throughput with the same level of ED resources. Notably, our analysis has already highlighted how ED physicians perceived senior leadership incentives in particular (i.e. focus strategy on higher revenue generating services). However, further observations were made by ED physicians regarding the incentives of other care providers placed upstream and downstream from the ED. In essence, the existing salary structure at Hospital XYZ was thought to contribute to a loss of potential throughput given that physicians lacked the incentive of caring for additional patients and in some cases went as far as capping admissions even though inpatient beds were available.

"It is convenience care for you the patient and for the physician in the clinic [located at Hospital XYZ outpatient services] because a lot of what we see, we see because either the attendings at the clinic don't want to add patients onto their day, they don't have any financial incentive to do so"

Hospital XYZ ED Physician 2

"Hospital XYZ is unique because it is a multi specialty group practice with salaried physicians. Here you know that if someone is getting an operation is because they need it... not because you need to pay your mortgage. People saw patients here who didn't have insurance because there was no reason not to see patients who didn't have insurance. [...] Conversely our salaried staff don't have an incentive to take care of more patients."

Hospital XYZ ED Physician 4

"And during the day the admitting team may have capped... they have taken all the admissions that they were going to take on their service for that day, so they may cap in the afternoon at 3 o'clock, and yet the next team might not be coming in until 6 o'clock, so they will take the name of the patient but when the six o'clock team or teams come in, there may be 8 patients who are waiting to be seen, and you may have not been able to get any orders written in the afternoon."

Hospital XYZ ED Physician 1

"This is a diagnosis driven department. A diagnosis establishes ownership and responsibility. In the clinic ownership does confer to financial benefit, which is different from the real world of medicine, if you are a surgeon in the real world of medicine and I say "I would like you to

see this patient because they have abdominal pain and I think this patient needs to be admitted". It is probable that even if you are not going to operate on that patient, and they have abdominal pain, you will put them on your service, and why? Because you can bill for that admission, if they need an operation you can bill for that operation, and if you piss me off I won't call you again because there are other surgeons available to accommodate my patients. Here everyone is salaried so an additional admission to your service... the best admission is an admission to someone else's service because they do the work and then you do the surgery."

Hospital XYZ ED Physician 3

"That is your livelihood, that is what pays for your kids college education, that is what puts the gold caps on your Lexus."

Hospital XYZ ED Physician 1

7.3.2.6 ED Knowledge View

"The implicit and tacit knowledge, capabilities, and intellectual property resident in the enterprise." (Nightingale 2009)

An immediate insight from analyzing the ED interviews from a Knowledge View is that it is useful to not only consider implicit and tacit knowledge (i.e. as originally described in the NREAF), but also explicit and codifiable knowledge, as well as the underlying requirements for knowledge transfer. Furthermore, it was useful to distinguish the types of knowledge in terms of information pertaining to the practice of medicine (e.g. administer a beta blocker drug within 15 minutes of a patient arriving with chest pain) and the management of an enterprise (e.g. contact hospital admissions bed board only after attaining approval from the attending of the desired inpatient specialty). With these clarifications in mind, some of the implications noted in previous sections are summarized below:

- External entities define evidence-based-medicine guidelines which are adopted by Hospital XYZ as these are part of the clinical metrics that the ED is monitored on.
- Unlike nurses and medical residents, ED physicians expressed an interest in seeing financial metrics pertaining to the ED and inpatient services they referred

to, but they said that they had been continuously denied access to such information.

- The hierarchy for each specialty's medical residency program is established to provide an adequate learning experience whilst ensuring safe and high quality care for patients. However, some specialties were singled out for having a greater adverse impact on the ED's patient flow, notably cardiology.
- The continuum of care during a patient's visit to Hospital XYZ is a legal requirement which implies different clinical staff exchanging information about the patient as well as medical responsibility for that patient. The exchange may take place within a single service unit (e.g. a shift change within the ED) or across service units (e.g. an ED patient being admitted to an inpatient specialty).
- Upon first evaluating a patient an ED physician may already know that he or she needs to be admitted. However, at times insufficient information is available and it may be necessary to keep the patient under observation in order for other symptoms to present themselves and/or for treatments to take effect before determining which inpatient specialty to admit the patient to.
- Several information transfer mediums are in place to help transfer both implicit and explicit knowledge

The admissions process of ED patients to inpatient specialties is one which is highly dependant on the tacit knowledge of the ED Charge Nurse. By definition Charge Nurses have a considerable amount of experience typically acquired while working in several different service units within the same hospital, thereby giving them tacit knowledge of organizational processes, supporting systems, and underlying culture. Furthermore, the ED Charge Nurse has to maintain real time information of bed availability both in the ED and at the different inpatient specialties. Inside the ED, although the EMR (i.e. T-System) allowed for visual management of bed availability, the Charge Nurse confided that she didn't trust the information and preferred to refresh her flow information through visual tracking instead. When probed further the Charge Nurse revealed that the two main issues giving rise to her distrust were the reliability of house keeping signaling that a bed had already been clean and the timeliness of an ED discharge notification. An additionally

important observation was that the Charge Nurse said she worked extensively beyond the four walls of the ED while troubleshooting and/or facilitating the admissions process at specific inpatient units of interest. Notably, she would benefit from acquiring real time information from each of the inpatient units she visited, but she would also jeopardize her ability to keep visual tracking of the ED patient beds.

Finally, an important aspect of practicing medicine in general is that there is always the possibility that an ED patient may present symptoms which are unknown to physicians thereby triggering inpatient specialty consults as a means of further refining a given diagnostic evaluation.

> *"There are always sometimes that no matter how long you have been in this [practicing medicine] you are always seeing something new, so sure, there are times that I am confused."*
>
> Hospital XYZ ED Physician 3

> *"You can consult with a service to try to admit the patient to that service. You can consult for additional information that will help you and your diagnostic evaluation. Or you can consult for an initial assessment with planned follow up. Most of the time you consult with a service because you expect the patient to be admitted to that service."*
>
> Hospital XYZ ED Physician 2

7.3.2.7 ED Information View

> *"Information needs of the enterprise, including flows of information as well as the systems and technologies needed to ensure information availability."* (Nightingale 2009)

An extensive amount of data concerning the ED Information View was collected and analyzed during the 1st ED Phase[96] and an immediate insight was to clarify that information systems may take forms beyond technology. Information flows aren't necessarily only facilitated through computer systems but also via paper systems and other means of communication (e.g. face-to-face meetings, telephone conversations,

[96] Please refer to section 7.3.1.

email, medical charts, etc). Upon inspecting the VSM description provided previously one can appreciate the extensive variety of systems in place which are used to support different key processes within and beyond the ED. An overview of these includes:

- Existence of fragmented EMRs where the ED has its own system (i.e. T-System) and the inpatient service units have their own system (i.e. MediTech) and neither system is integrated with one another. System integration is facilitated via paper printout from T-System whenever a patient is admitted to an inpatient service.
- Patient admissions require additional system called "Pre Admit Bed Tracking System" whereby ED Charge Nurse can keep track of her bed requests in inpatient service units. Additionally, the hospital bed admissions board may communicate with the ED via telephone and/or beeper.
- Patient medical chart is in paper format and is updated by multiple clinical staff
- Patient orders written at triage are in paper format
- ED clerical staff insert data into the T-System and also the MediTech system (for billing purposes) but not necessarily one immediately after the other (i.e. time lag)
- ED inserts lab test requests (e.g. blood, tissue, etc) in a cumbersome to operate old system, and receives test results directly in T-System. Notably, lab test requests are also printed in paper format and sent together with patient specimen in a plastic carrier to the laboratory via a pneumatic tube.
- ED writes radiology orders on paper and receives test results signal directly in T-System which requires subsequent retrieval of images in a separate system

Furthermore, some of the implications noted in previous sections of 2nd ED Phase are summarized below:

- The patient medical chart is a legal document in paper format which is updated continuously by various clinical staff located in the different service units that a given patient goes through.
- ED physicians appreciate the evolution in nursing staff ability in providing them ahead of time with an overview of patient information (e.g. chief complaint, allergies, etc) in paper format.

- The ED Charge Nurse doesn't trust the accuracy of the T-System information concerning ED bed availability and relies on visual inspection instead.

7.3.3 3rd ED Phase: Archival record analysis

In the introduction of this chapter we noted that over time a trust based relationship was developed with senior leadership at Hospital XYZ which among other things allowed us to access additional data to further inform our research. Data access was released in incremental steps as senior leadership required debriefing of analysis results in both document and presentation format. This procedure proved useful on several counts. First, by sharing our findings with senior leadership we were able to test their validity firsthand and address any concerns that surfaced. Second, the exploratory in-depth case research method warranted an incremental approach as phenomena of interest emerged and our underlying understanding of enterprise architecture matured along with our knowledge of Hospital XYZ's operation and potential data sources. Third, as we neared theoretical saturation and continuously sought validation from senior leadership, we were finally granted access to very sensitive financial data pertaining to each patient visit.

In terms of archival record access (i.e. electronic data records) three main gatekeeper events took place. The first system to be analyzed was the ED's EMR (i.e. T-System). The second system to be analyzed was the "Pre Admit Bed Tracking System" in conjunction with the ED's EMR. The third and final dataset analyzed was equally sourced from the ED as well as the inpatient EMR and included financial data pertaining to each patient visit. What follows is a description of each of these gatekeeper events including how the data was acquired, subsequently analyzed, our findings, and reactions by senior leadership[97]. Such detailed descriptions are useful as they provide further insight into Hospital XYZ's EA Views.

[97] Care was taken to conduct interviews with Hospital XYZ's senior leadership before they saw any findings stemming from quantitative data analysis so as to minimize the potential of inducing bias in their answers. However, for the sake of readability, the outcome of archival record analysis are presented now and all at once.

7.3.3.1 ED EMR Analysis

Addressing Hospital XYZ's inability to analyze its own data: Access to the ED's EMR (i.e. T-System) wasn't so much of a problem in terms of data clearance but rather in terms of system data extraction. The T-System is a proprietary software which includes default scripts that allow users to run preset analysis reports (e.g. total number of patients seen in the ED in a given time period; average and total length of stay of patients in the ED). As of 2007 the T-System didn't offer the capability to run custom analysis reports and indeed charged an extra fee if Hospital XYZ desired that service. As such, the decision was made to leverage existing resources and extract data from the ED EMR for subsequent external analysis. The T-System's inbuilt data extraction options also proved restrictive as they only allowed for the generation of Adobe Portable Document Format (PDF) files or Microsoft Excel files formatted in such a way that prevented external analysis. Fortunately, the T-System's own internal database was XML enabled which following a series of data tool manipulations was extracted into a convenient external file. The take away of this data extraction overview is that Hospital XYZ, and indeed any hospital running the T-System under the same configuration, was essentially incapable of conducting data analysis beyond the inbuilt basic reports unless it paid a considerable amount to the software vendor or had the unlikely database technical expertise in-house to do so.

Assessing the extent of ED overcrowding: The first step in our ED quantitative analysis was to assess to what extent ED overcrowding was indeed taking place. Figure 7-5 displays the ED patient arrival rate by hour of day and acuity in a given month[98].

[98] The data in the following figures, and indeed in the remainder of this subsection, describe the ED activity during the 1st month of onsite visits made to Hospital XYZ. The sampling of the particular month was determined by it being the only month available in the "Pre Admit Bed Tracking System" (please refer to section 7.3.3.2). Said month had a total of 2970 patient visits, which represents an average of 99 patients a day, and is consistent with the total annual ED volume of 36,000 patients. Detailed information on each of the patients was analyzed for that given month. Data analysis on each of the preceding eight months yielded similar outcomes and were validated by senior leadership as well as ED clinical staff. Furthermore, the number of inpatients discharged from the hospital, and who were originally admitted through the ED, is within the range for all months in 2006 (i.e. ED represents on average 44.58% of all inpatient discharges in 2006, where the MIN was 42.95% and MAX was 46.37%. The analyzed month was 43.72%).

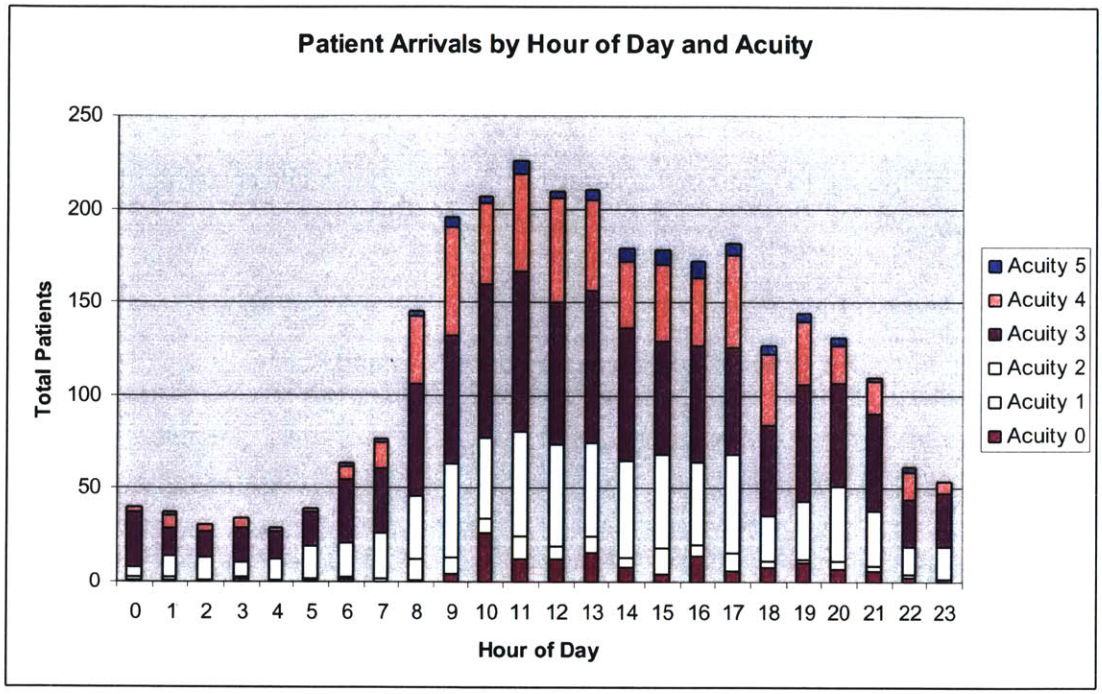


Figure 7-5: 1 ED Patient Arrivals by Hour of Day and Acuity (1 month's data)

Notably only 5 acuity levels exist (i.e. 1- most severe; 5- less severe) but in 5.1% of the patient records failed to register the patient acuity and were thus counted as "Acuity 0"[99]. The figure includes all ED patients for that given month, meaning that both non-admitted patients (e.g. discharged home or to another medical facility) and admitted patients (e.g. transferred to Hospital XYZ inpatient service unit). On average each day for every hour from 8am to 9pm there are 100 or more patients arriving to the ED, and the arrival rate drops consistently in the remaining hours of the day. The bulk of ED patients consists of acuity level 3 patients (40.3%), followed by acuity level 2 patients (26.1%), acuity level 4 patients (21.9%), acuity level 1 patients (3.9%), and finally acuity level 5 patients (2.7%). As many as 75% of acuity levels 4 and 5 patients arrive between 10am and 10pm which

[99] The attribution of "Acuity 0" did not express any tendency correlated to the patient's urgency of care as evident in the following sample of chief complaints: *trauma fall (normally level 1); attempted suicide (normally level 2); flu like symptoms(normally level 3); finger tip laceration (normally level 4); recheck suture removal (normally level 5)*

consists of the hours of operation for the "Minor ED"[100] (i.e. four ED rooms are labeled as minor).

Figure 7-6 displays the ED patient discharge rate by hour of day and acuity in the same month as before[101].

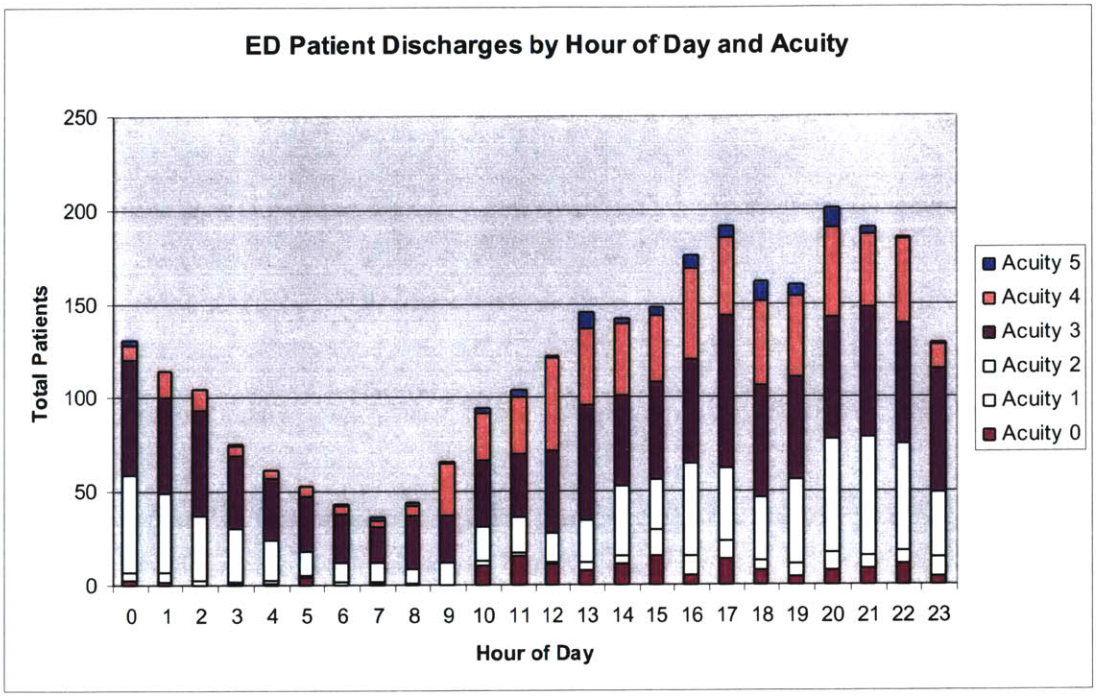


Figure 7-6: ED Patient Discharges by Hour of Day and Acuity (1 month's data)

Once again both non-admitted and admitted patients are displayed. On average each day for every hour from 11am to 2am there are 100 or more patients departing from the ED, and the departure rate drops gradually during the night and early morning. As many as 77.6% of acuity levels 4 and 5 patients are discharged between 10am and 10pm (i.e. "Minor ED" in operation).

[100] The concept behind the "Minor ED" is to allow for patients who have minor injuries (e.g. acuity levels 4 and 5) to be seen faster and in a room where there is less capital investment (e.g. equipment, raw material, etc) and less labor (i.e. nurse to patient ratios are lower in the "Minor ED" than in the "Main ED"). Additionally, by increasing the throughput of minor injuries the availability of the waiting area is increased.
[101] Given that data pertains to the same month the previously quoted statistics remain the same (i.e. total number of patients by acuity level)

Figure 7-7 displays the total number of patients in the ED by hour of day. The analysis takes into account the rate of arrival and departure and calculates the remaining patients still left in the ED at any given hour of the day. The figure also demonstrates how the ED is continuously overcrowded from 9am to 1am (i.e. 22 beds available from 10am to 10pm, and then the minor injury ED beds close, thus only 18 beds are available in the remaining time) and is consistent with the evidence collected through interviews and observation during the 1st and 2nd Phases of ED data collection and analysis. Interestingly 93.9% of the patient records lacking an acuity level (i.e. Acuity 0) arrived in the ED when it was overcrowded which may be representative of how data entry deteriorates when the ED is overcrowded.

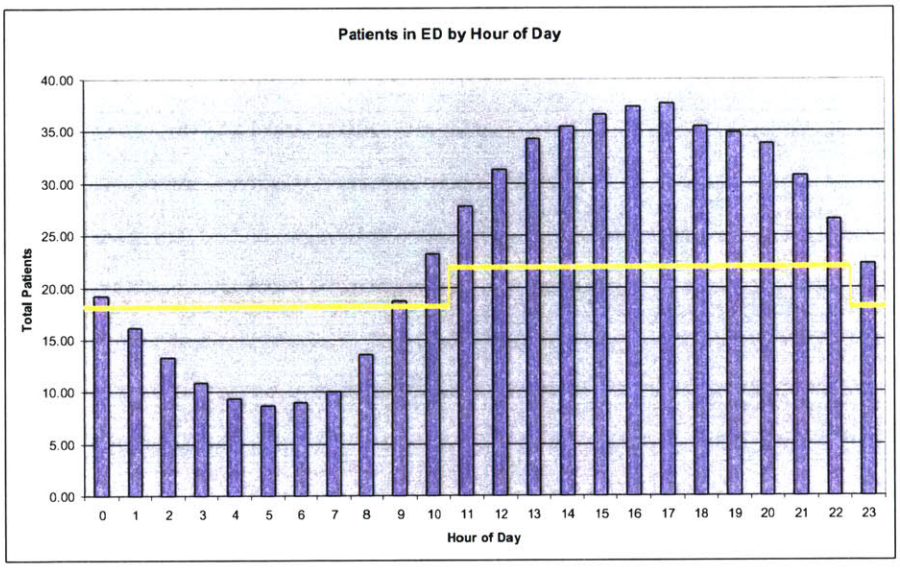


Figure 7-7: Total Number of Patients in ED by Hour of Day

Measuring ED value stream throughput: The 1st and 2nd phases of ED data collection and analysis were consistent in that ED overcrowding was occurring and that admitted patients were spending a considerable amount of time in the ED (i.e. patient boarding[102]). The total time spent in the ED (i.e. length-of-stay or LOS[103]) is an important metric because longer LOS "*may compromise quality of care and contribute to delays in the*

[102] Specifically, a patient may have been deemed admissible to a given inpatient service but will remain in the ED as an admitted patient.
[103] ED LOS represents the time elapsed from the patient check-in until the time the patient is discharged from the ED (i.e. patient physically leaves the ED whether he or she is admitted to the hospital or was treated as an outpatient).

emergency evaluation of other patients." (Herring, Wilper et al. 2009). Specifically, a longer ED LOS has been found to contribute to increased LOS for the hospital as a whole, to a greater number of patient complications (i.e. morbidity), and an increased mortality rate amongst critically ill patients (Cowan and Trzeciak 2005; Chalfin, Trzeciak et al. 2007). A recent study by Press Ganey Associates, a healthcare quality improvement company, determined that the average ED LOS in the US was 4h00 (Press_Ganey 2010)[104].

With the benefit of ED archival records we proceeded with the analysis of Hospital XYZ ED's overall value stream[105] throughput and subsequently decomposed it for each patient type specifically (i.e. non-admitted and admitted)(Figure 7-8, Figure 7-9, and Figure 7-10).

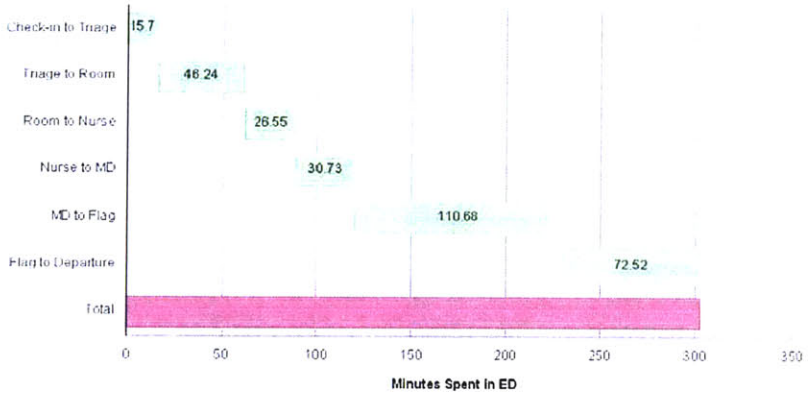


Figure 7-8: ED Value Stream Overall Throughput (non-admitted and admitted patients)

[104] The same study mentioned that the LOS varied considerably by US State, which is consistent with our previous observations on the limitations of comparing hospitals (please refer to Chapter 5). Additionally, having contacted a Press Ganey Associates representative they further clarified that the data is based on patient satisfaction surveys and does not include patient boarding time. Despite these limitations the organization is considered a reputable and primary benchmark service provider in the US.

[105] Please refer to Figure 7-2 and Figure 7-3 for the ED's Value Stream Map. Times denote elapsed time, for instance "Check-in to Triage" denotes the time between the patient checking-in with the ED clerk and beginning the triage process with the Nurse Practitioner. "MD" represents ED Physician. "Flag" means that an ED Physician has completed the patient diagnostic and ED treatment, and has made a disposition (e.g. discharge patient home; initiate admitting process to an inpatient specialty; etc)

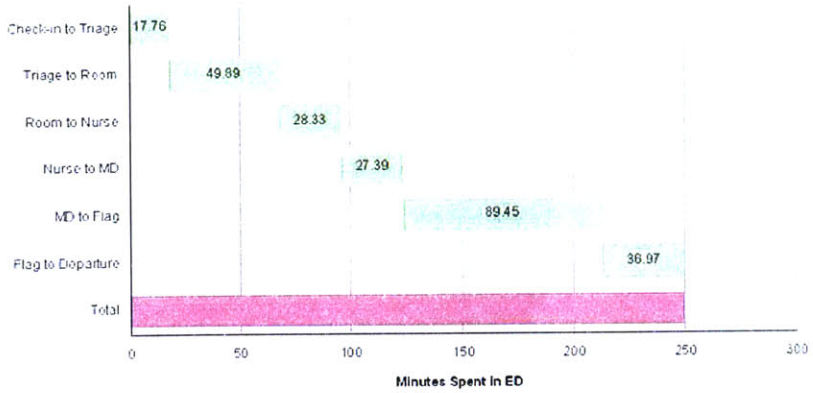


Figure 7-9: ED Value Stream Throughput for Non-Admitted Patients

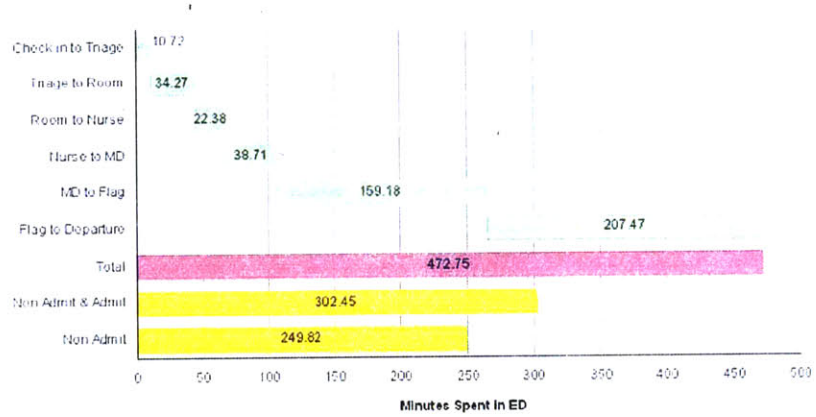


Figure 7-10: ED Value Stream Throughput for Admitted Patients

When comparing each of the ED's value stream throughputs the following observations can be made:

- On average an ED patient spends 5h00 inside the ED. However, whereas non-admitted patients spend on average 4h09 inside the ED, the admitted patients spend close to twice that amount, namely 7h52. This is consistent with the ED physicians' observations that the admitted patients were causing a significant bottleneck to the ED flow.
- Non-admitted patients take longer to begin their triage process, to be assigned an ED room, and finally to be seen by an ED nurse. However, their assessment, treatment, and discharge are considerably swifter than those of admitted patients.

- Admitted patients take longer to be seen by an MD once in the ED room, as well as for the remaining ED key processes. The process "MD to Flag" takes considerably longer but it makes sense given that admitted patients are generally in a more severe medical condition and require a longer ED assessment and treatment time (i.e. *kick the tires*). However, "Flag to Departure" clearly denotes that admitted patients remain a considerable amount of time in the ED (i.e. approximately 3h30) after an admission decision was made by the ED physician.

Measuring ED Throughput Specific To Each Patient Type: In the course of the 2nd ED Phase of data collection and analysis, physicians observed that the ED was less able to address the needs of the surrounding community given the high demand generated by senior leadership for urgent inpatient specialty care. Figure 7-11 describes the average ED LOS for both non-admitted and admitted patients while distinguishing their assigned acuity level.

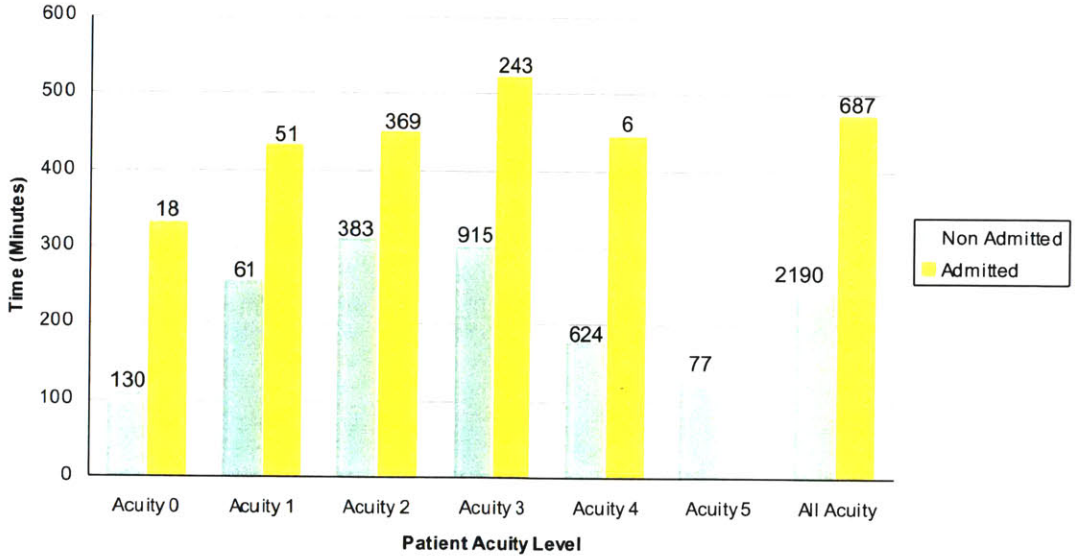


Figure 7-11: Average ED LOS per Acuity and Patient Type[106]

As before admitted patients spend inside the ED close to twice the amount of time non-admitted patients. Patients of a lesser acuity, namely levels 4 and 5, spend considerable less time inside the ED as compared to other patients and most likely due to the existence

[106] The values at the top of each bar denote the absolute number of patients per acuity level and type.

of the dedicated "Minor ED" beds (i.e. the bulk of acuity level 4 and 5 patients are inside the ED while the "Minor ED" is open)[107]. The key take-away is that acuity level 3 patients that are admitted spend on average 8h40 inside the ED. Such is consistent with the initially mentioned observation that urgent inpatient specialty care patients were delaying the care of less urgent patients. Finally, one can note that the ED admissions rate is 24%, meaning that from all patients visiting the ED, 24% of them are admitted as inpatients.

Measuring ED Balking Rate (i.e. left without being seen): Whenever triaged patients leave the ED without being seen by a physician they are assigned a discharge disposition of "Left Without Being Seen" (LWBS). ED overcrowding is said to be a prime contributor to the serious occurrence of patients LWBS (Rowe, Channan et al. 2006). LWBS patients who might have initially had minor issues may delay their care and consequently deteriorate in health unnecessarily (Derlet and Richards 2000). As such, measuring LWBS is an important indicator of patient overcrowding as well as of quality of care and ultimately performance (Akerke Baibergenova and Sharon 2006).

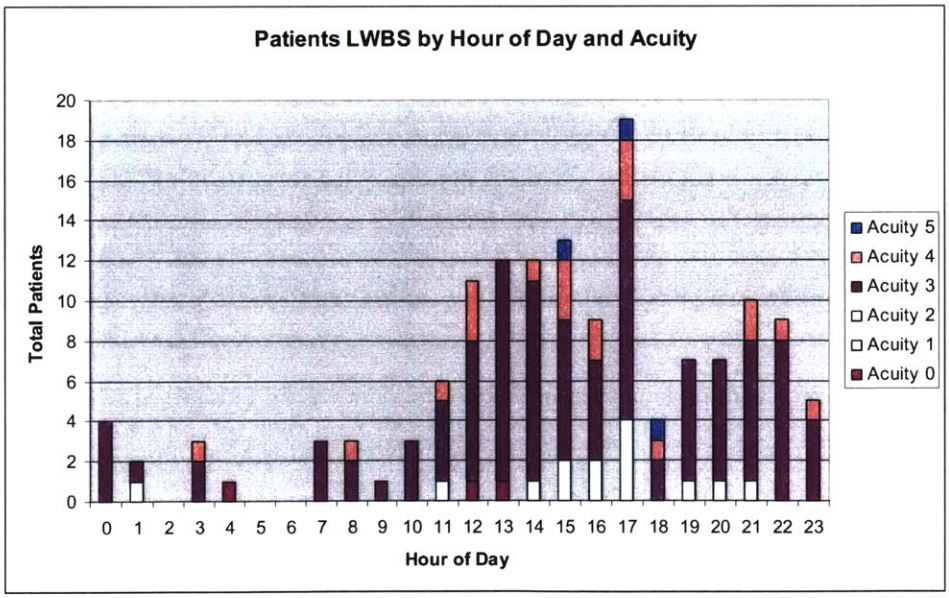


Figure 7-12: ED Patients LWBS by Hour of Day and Acuity

[107] Notably, the six admitted patients with acuity level 4 spent a considerable time in the ED (i.e. 7h25 on average) but not only the sample denotes it is a rare event (i.e. 0.2%) but clinical staff also explained that a patient might have significantly deteriorated while in the ED, or he or she was inappropriately triaged at first, or it might have been a clerical data error.

Figure 7-12 shows that the ED experienced a total of 5% of patients leaving without being seen. In reference to Figure 7-7 one can see that the highest rate of LWBS took place between 5pm and 6pm (i.e. total of 19 patients) which is precisely the same time when the ED was experiencing the highest rate of overcrowding. In general the same correlation can be observed at the remaining times of day. Previous studies concluded that most of the LWBS patients had been triaged as lower acuity (i.e. levels 4 and 5)(Rowe, Channan et al. 2006). Hospital XYZ's ED however has the reverse patient behavior in that only 15.9% of the patients LWBS are of lower acuity, and as much as 72.2% are of acuity level 3, and even more worrying is the 9.7% of acuity level 2 patients.

Validation of ED EMR Analysis with Hospital XYZ's Senior Leadership: Having completed the ED EMR analysis our results were shared and validated with senior leadership in both document and presentation format. Some of the key insights senior leadership said they had gained from the analysis included:

- ED Value Stream Throughput Awareness: never before had leadership been able to see quantitative data depicting the time spent in each of the key processes inside the ED. They were surprised to see how little time was spent between check-in and going through triage, which prompted them to cancel their localized improvement plan of purchasing expensive self check-in kiosks for the ED.
- Length of Patient Boarding: senior leadership acknowledged it knew of the ED's problem with patients boarding. However, they had yet to see actual numbers and were surprised with the magnitude of the "Flag to Discharge" time for admitted patients.
- Information Systems Limitations: senior leaders weren't aware of several of the fields which were captured in the ED's EMR and valued the opportunity of generating reports beyond the limited preset made available by their software vendor. However, they also shared that they weren't quite aware of the full extent of data insertion reliability issues.
- Rate of Patients Left Without Being Seen: leaders thought that their rate of patients LWBS was at par with the national average (i.e. 2%). Their reaction upon

learning otherwise was of disbelief and grave concern and especially so given the number of more critical patients leaving.

The end result of this first gatekeeper event was that leadership validated, supported, and granted further access to additional patient flow related information systems (i.e. inpatient EMR and the "Pre Admit Bed Tracking System"). The intent was to analyze more closely the patient flow between the ED and inpatient service units and try to understand what was contributing to the "Flag to Discharge" time of admitted patients. Additionally, walkthrough and interview access was also granted to study Clinical Support Services and Administrative Support Services.

7.3.3.2 Extended Patient Flow Analysis (ED EMR + Bed tracking)

Addressing Hospital XYZ's inability to analyze its own data: Once again, as before, there were difficulties in being able to extract the necessary patient data in order to conduct an analysis of patient flow from the ED onto the different inpatient service units. The "Pre Admit Bed Tracking System" was equally accessible in terms of generating an export file in Microsoft Excel, but as a homegrown solution had two significant limitations. Firstly all patient data was indexed by patient name and didn't have any medical record numbers therefore requiring additional sensitive filtering and data manipulation. Secondly only the previous month's worth of data was available (i.e. the month analyzed in 7.3.3.1). Ad-hoc data integration exercises were conducted with the ED Charge Nurse, several inpatient service unit Charge Nurses, the IT Director, and Quality & Safety Engineers. Data schemas of each IT system were printed and covered a 15 feet table so as to visually track and determine what each data field could tell us about the patient flow. Notably the IT Director and Engineers were as oblivious as we were in terms of what the data schemas meant. As for the Charge Nurses they were able to relate to their particular system's data schema but at times also revealed different mental models as to what each data field meant. The take away of this data extraction overview is that Hospital XYZ has multiple information systems both off-the-shelf (some of them state-of-the-art) and homegrown which aren't integrated with one another and

understandably aren't featured holistically in any of Hospital XYZ's existing performance reports and indeed mental models.

Measuring ED and Inpatient Service Unit Interaction Throughput: Having measured the magnitude of patient boarding in the ED, analysis proceeded towards measuring the timeliness of the interaction between the ED and the various Inpatient Service Units. To that effect we leveraged several fields in the different IT systems in order to track patient flow as well as key processes (see Figure 7-13 for a simplified version).

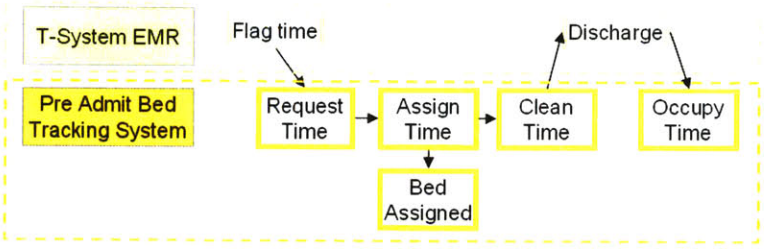


Figure 7-13: Tracing Patient Flow in Fragmented IT Systems

The "Flag Time" to "Occupy Time" represents the time elapsed from an ED physician making the decision to admit a patient to the time that patient occupies a bed in an inpatient service unit. Thus it is a proxy for the timeliness of the interaction between the ED and an inpatient specialty which ultimately allows for a patient to be admitted to their service and consequently to an inpatient service unit.

Table 7-1: ED inpatient admission timeliness

Description	Elapsed Time
Average	4h02
Standard deviation	2h17
Maximum observation	12h43
Minimum observation	1h31

Table 7-2: ED admission timeliness per inpatient service unit

Inpatient Service Unit	# of beds	Bed type(s)	Patient condition sample	# admissions from ED	Elapsed Time
2E	24	Surgical ICU / Medical ICU	Major trauma; postoperative multisystem failure; liver/kidney transplant	6	2h47
5C	16	ICU / Cardiac Care Unit	Ventilator support and EKG monitoring; intracranial monitoring; etc	11	2h28
5W	**36**	**Telemetry only**	**Coronary intervention; electrophysiological procedures; arrhythmia; CHF; angina; MI**	**94**	**4h30**
6C	36	General Medical / Surgical	Liver transplant; hepatobiliary surgery	32	4h01
6E	24	Telemetry only	Cardiothoracic surgery; vascular surgery	34	4h20
6S	18	Medical/Surgical/Telemetry	Back pain; jaw pain; chest pressure	53	4h06
6W	27	Medical/Surgical/Telemetry	Peritoneal dialysis; pulmonary	92	3h57
7C	**38**	**Medical/Surgical**	**Neurosurgery; orthopedics; trauma**	**50**	**3h31**
7E	30	Medical/Surgical	Renal and urological disorders; Kidney transplant	27	4h05
7S	18	Medical/Surgical/Telemetry	Chest pain; pneumonia; fever	48	4h06
7W	35	Medical/Telemetry	Hematology and medical oncology	56	3h54

Source: ED EMR and Pre Admit Bed Tracking System. 1 month data.

As per Table 7-1, a patient admission takes on average more than 4h00. Upon breaking down the admission time per each inpatient service unit, we found that different floors interacted with the ED with significant timeliness difference (see Table 7-2). Hospital XYZ has a total of 11 inpatient service units which are equipped with one or more types of patient beds, and serviced by nurses with specific training to care for various patient conditions. The patient bed types are typical of most hospitals but as Table 7-2 illustrates, Hospital XYZ as multispecialty hospital caters for a broad spectrum of patient conditions, from typical (e.g. fever, pneumonia, back pain) to highly specialized (e.g. liver transplant, cardiothoracic surgery, coronary interventions, etc). Furthermore:

- Two inpatient service units measured the lowest timeliness of ED interaction at approximately of 2h30. However, said units, namely 2E and 5C are high intensive care units and seldom interact with the ED, as evidenced in our data sample.
- Two inpatient service units measured at opposite sides of the timeliness ED interaction spectrum, namely 5W (worse unit) and 7C (best unit). Both units have a comparable number of beds and registered a high frequency in our data sample, but they are geared towards different patient populations. Said units cater to a large portion of patients from the specific inpatient specialties mentioned by ED physicians and nurses as being worse (i.e. cardiology) or better (i.e. neurosurgery and orthopedics)to work with[108].

Measuring ED bed request behavior: In section 7.3.2.4 we noted that different physicians adopted different approaches in the bed admission process. A primary distinction was that some ED physicians would first seek approval by an inpatient specialty attending before requesting an inpatient bed for that service, whereas other physicians admitted they didn't follow that standard, and indeed nurse interviews confirmed that behavior. However, given the existence of archival records we could measure this behavior and determine to what extent it was happening. To that effect a good proxy was to identify whenever a "Request Time" happened before a "Flag Time", which clearly denotes that a bed was requested ahead of time (i.e. the ED had yet to flag

[108] Please refer in particular to sections 7.3.2.3, 7.3.2.5, 7.3.2.6.

the patient, let alone get the inpatient specialty attending's input)[109]. We found that on 51% of patient admissions, beds are requested before patients being flagged and on average this happens 1h33 ahead of time.

Uncovering clinical support staff opportunity: In examining the time between "Occupy Time" and "Clean Time" we determined that on average 2h28 elapsed and that 50% of the beds cleaned remained unoccupied for at least 2h04.[110] That being the case, considering that 687 patients were admitted from the ED during that month, when extrapolating for a whole year, Hospital XYZ would have approximately 710 unoccupied patient bed days, or 169 less patient admissions.

Validation of Extended Patient Flow Analysis with Hospital XYZ's Senior Leadership: Having completed the Extended Patient Flow analysis our results were shared and validated with senior leadership in both document and presentation format. Senior leadership further refined its understanding of the level of Hospital XYZ's state-of-the-art IT fragmentation and appreciated the value and ability of analyzing patient flow beyond the ED. The end result of this second gatekeeper event was that leadership validated, supported, and granted access to Inpatient Service Units of interest. Furthermore, archival record access was given to the inpatient EMR (i.e. MediTech).

7.3.3.3 Inpatient EMR Analysis

State-of-the-art Inpatient EMR: Hospital XYZ's inpatient EMR (i.e. MediTech) is the leading EMR software in the US and proved to be very accessible both in terms of extracting the required data in both XML and Microsoft Excel format as well as in enabling a longitudinal data set (i.e. one year's worth of data comprising 24,200 patient discharges). The dataset includes several fields which allow for further insight into

[109] Notably, this analysis also needs to take into account the data insertion reliability issues previously mentioned (i.e. although "Request Time" is always accurate the "Flag Time" may not necessarily reflect when the patient was indeed flagged in the ED given that the nurse may be busy with something else until she actually inserts it into the T-System).

[110] Less than 1% of beds had a "Clean Time" to "Occupy Time" of 0, which meant that such beds were already clean before being requested, and therefore housekeeping didn't introduce any delay into the patient flow.

Hospital XYZ operations as well as inpatient related revenue sources. Specifically, for each inpatient discharge it describes the admission source (i.e. where the patient originally came from), the inpatient service unit (i.e. where the patient was cared for), the inpatient specialty (i.e. who was ultimately responsible for the patient), the length of stay (i.e. how long the patient stayed in the hospital), the patient's insurance carrier, and billing related information.

Assessing the contribution of each of Hospital XYZ's Admission Sources: Admission sources for hospitals are essentially from three categories, namely the ED (which includes hospital transfers), the clinics (which schedule elective cases for patients as opposed to emergency cases), and internal hospital consults (which represent patient transfers between inpatient service units). Figure 7-14 describes the contribution of each of Hospital XYZ's admission sources in terms of total patient referrals, total length of stay, and total revenue charge capture from medically related inpatient services.

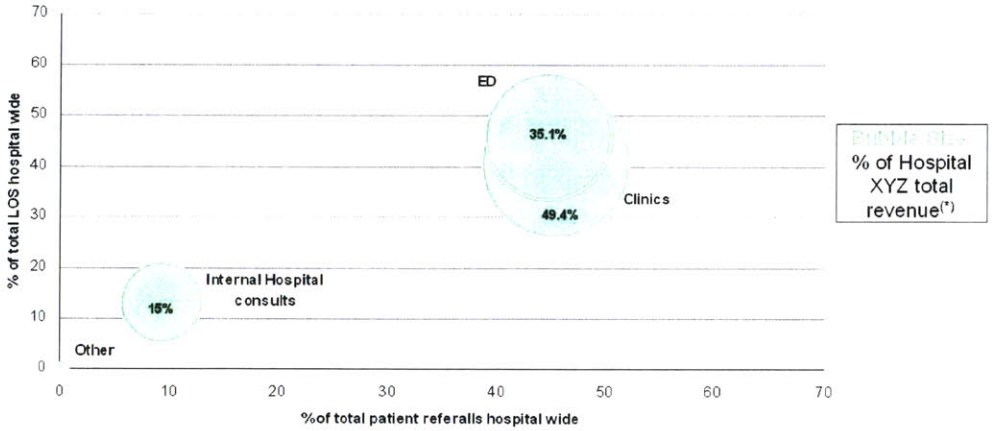


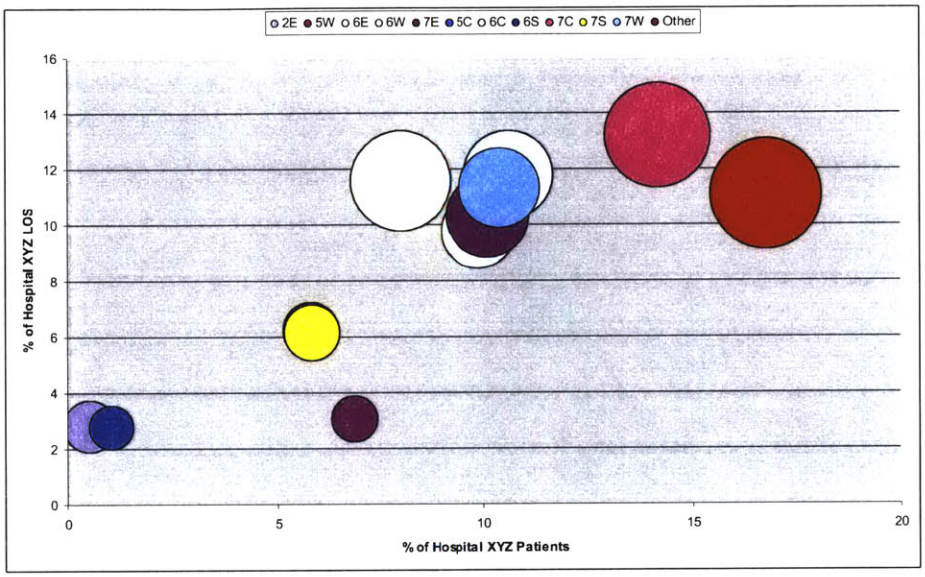
Figure 7-14: Hospital XYZ Contribution by Admission Source (*)[111]

To begin with we determined that the ED has a sizeable contribution to Hospital XYZ as compared to other admissions sources (i.e. referrals from clinics and internal hospital consults between services). Succinctly, the ED's admitted patients represent 45.85% of Hospital XYZ's total length-of-stay, stemming from a referral volume of 44.70% of

[111] For a detailed description on how each admission's source revenue contribution was estimated from using Medicare Diagnostic Related Group (DRG) baseline payments, please refer to Appendix IV(ii)

Hospital XYZ's total referrals, which ultimately contribute to 35.12% of the revenue charge capture from Hospital XYZ's medically related inpatient services.[112]

Assessing the contribution of each Inpatient Service Unit: Next we inspected the contribution of each of Hospital XYZ's inpatient service units described previously in Table 7-2.



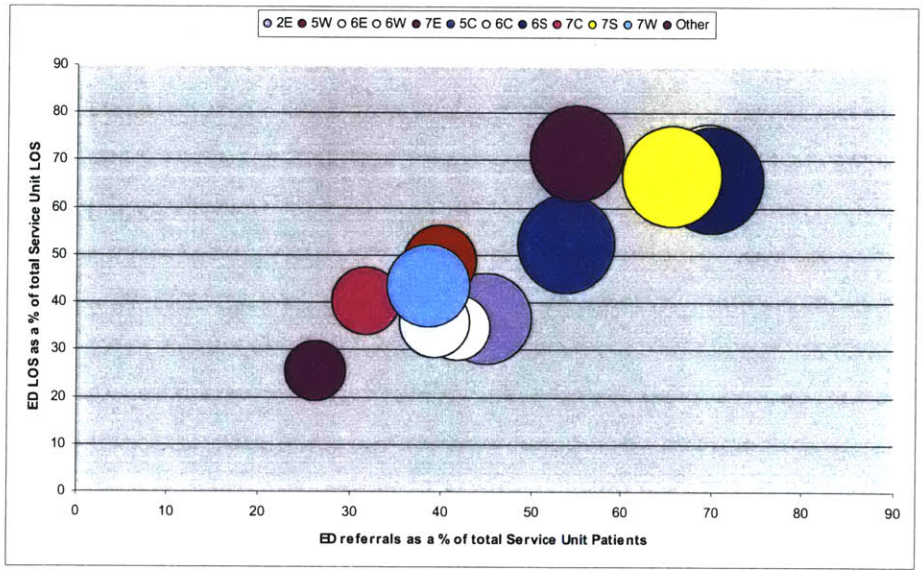
Bubble size: % of Hospital XYZ total revenue

Figure 7-15: Inpatient Service Unit Contribution

As per Figure 7-15, the inpatient service units 5W and 7C see the greatest number of patients, generate the most revenue charge capture, and are amongst the highest contributors to the total LOS of Hospital XYZ. Specifically, 5W contributes with 16.7% of total patients, 11.11% of total LOS, and 16.7% of total revenue charge capture from Hospital XYZ's medically related inpatient services. Meanwhile 7C contributes with 14.1% of total patients, 13.2% of total LOS, and 14.8% of total revenue charge capture.

[112] Data access was only provided to the principal diagnostic, primary procedural codes, and equivalent DRGs which are established by Medicare. Notably, given the inherently lower payments pertaining to Medicare in some markets, hospitals have been known to cost shift, meaning that they charge higher prices to private insurers in order to compensate. Furthermore, hospitals differ in their ability to negotiate more favorable contracts with insurance carriers. Therefore, the use of DRGs as a proxy is not necessarily representative of the full potential revenue generated by Hospital XYZ's medically related inpatient services. Specifically, the DRG proxy applied to the 24,200 inpatient discharges of a single year, generated a revenue of $244,371,405, when Hospital XYZ's public annual report stated close to $700,000,000 for the same period.

Assessing ED's contribution to each Inpatient Service Unit: A useful construct is that of analyzing the contribution of each inpatient service unit whilst considering the ED as the source of admission. For instance, "*considering the total patient population of inpatient service unit 5W, how many of them were originated from an ED admission?*" Similarly, as before, the same analysis is done in terms of the total length of stay and the revenue charge capture, but this time it is in relation to each unit's own totals (as opposed to the whole hospital).



Bubble size: % of inpatient service unit total revenue

Figure 7-16: ED's Contribution to Inpatient Service Units

Figure 7-16 is further evidence that the ED has a sizeable contribution to Hospital XYZ as compared to other admissions sources. For instance, the ED generates at least 25% of all the patient referrals and subsequent LOS for every inpatient service unit, and in some cases as much as 70% of an inpatient service unit's referrals (i.e. 6S and 6W). Similar observations can be made in terms of the total revenue charge capture.

Furthermore, referring back to the highlighted 5W and 7C, we also note that the ED's contribution is similar for each one of them. Specifically, 5W receives from the ED 39.9% of its total patients, which represent 48.7% of its total LOS, and contribute with 29.1% of its total revenue charge capture. Similarly, 7C receives from the ED 31.7% of

its total patients, which represent 40.4% of its total LOS, and contribute with 25.9% of its total revenue charge capture.

Assessing ED's contribution to each Inpatient Specialty : Having assessed the ED's contribution to Hospital XYZ as a whole and to each inpatient service unit specifically, the final step was to analyze the ED's contribution to each Inpatient Specialty, since, as noted before in Table 7-2, one or more specialties may be centralized at a given location. Table 7-3 describes each of the 30 inpatient specialties at Hospital XYZ and assesses the contribution of each inpatient specialty in relation to the hospital overall, in terms of total patient volume, LOS, and revenue charge capture. Furthermore it does a similar analysis in terms of the ED's contribution to each specialty.

Table 7-3: Assessing inpatient specialty contribution

			In relation to Hospital XYZ overall			In relation to Inpatient Specialty		
#	Inpatient Specialty	Description	% contribution patient volume	% contribution LOS	% contribution revenue	% ED contribution patient volume	% ED contribution LOS	%ED contribution revenue
1	H_GIMC	General Internal Medicine	26.27%	24.62%	16.74%	86.57%	84.18%	84.07%
2	H_CARD	Cardiology	13.65%	9.32%	17.36%	10.87%	17.15%	12.05%
3	H_UROL	Urology	7.53%	6.67%	6.50%	14.03%	13.23%	10.60%
4	H_GENS	General Surgery	6.80%	6.26%	6.23%	50.92%	61.31%	55.07%
5	H_ORTH	Orthopedics	6.45%	6.00%	7.23%	17.31%	20.63%	15.18%
6	H_NESG	Neuro Surgery	5.91%	4.43%	7.08%	8.39%	20.02%	11.66%
7	H_COLS	Colorectal Surgery	4.27%	5.88%	4.84%	32.19%	26.16%	22.96%
8	H_GYNC	Gynecology	3.80%	2.89%	2.73%	6.47%	5.64%	4.74%
9	H_NEUR	Neurology	3.72%	3.39%	2.61%	70.45%	66.10%	67.23%
10	H_PULM	Pulmonology	3.52%	6.97%	5.39%	66.50%	64.44%	63.93%
11	H_HEPA	Hepatology	2.81%	4.48%	4.71%	11.83%	6.90%	5.19%
12	H_COMM	Multiple System Failure	2.73%	2.63%	1.90%	84.97%	83.51%	81.39%
13	H_THOS	Thoracic Surgery	2.59%	4.69%	7.20%	11.83%	16.09%	13.43%
14	H_GAST	Gastroenterology	2.29%	2.37%	1.64%	60.08%	51.65%	57.37%
15	H_VASS	Vascular Surgery	1.98%	2.83%	2.55%	14.60%	20.28%	15.51%
16	H_OTOL	Otolyngarology	1.25%	1.03%	1.43%	10.69%	8.30%	7.55%
17	H_HEMA	Hematology	0.94%	1.69%	1.07%	38.53%	29.62%	28.90%
18	H_ONCO	Oncology	0.92%	1.43%	0.84%	50.23%	50.99%	50.75%
19	H_PLAS	Plastic Surgery	0.59%	0.35%	0.27%	14.71%	10.29%	16.25%
20	H_VASM	Vascular Medicine	0.59%	0.58%	0.63%	54.41%	52.26%	51.57%
21	H_GERI	Geriatrics	0.40%	0.37%	0.28%	80.43%	79.62%	74.50%
22	H_NEPH	Nephrology	0.40%	0.33%	0.27%	32.61%	27.02%	33.50%
23	H_ENDO	Endocrinology	0.25%	0.19%	0.12%	46.55%	63.83%	46.76%
24	H_INFD	Infectious Diseases	0.15%	0.23%	0.09%	51.43%	42.15%	47.19%
25	H_RHEU	Rheumatology	0.12%	0.30%	0.22%	81.48%	82.03%	79.45%
26	H_IRAD	Interventional Neuroradiology	0.03%	0.01%	0.03%	0.00%	0.00%	0.00%
27	H_OPTH	Ophthalmology	0.03%	0.03%	0.03%	50.00%	57.14%	82.64%
28	H_TRAU	Trauma	0.01%	0.01%	0.01%	100.00%	100.00%	100.00%
29	H_MISC	Miscellaneous	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
30	H_PAIN	Pain	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 7-3 tells us that Hospital XYZ draws from six inpatient specialties over 60% of its patient volume, LOS, and revenue charge capture from medically related inpatient services. By inspection, the four inpatient specialties that deserved specific mentioning by ED's clinical staff[113] are featured in these top six inpatient specialties. Recapping on our previous findings, neurosurgery and orthopedics services were said to be better to work with and they responded to ED requests in an adequate timeline and helped ED flow. Conversely other services such as cardiology were described in a much dimmer light considering their practice of consistently exercising their *right of first refusal.* Finally the GIM service was described sympathetically as overburdened as well and performing as best as possible given the circumstances.

Furthermore, these findings are also relevant in the context of our extended patient flow analysis[114] where we found that inpatient service unit 5W and 7C were at opposite sides of the spectrum in terms of their timeliness in interaction with the ED. Recapping, 5W is mostly associated with the cardiology inpatient service, whereas 7C is mostly associated with neurosurgery and orthopedics[115]

7.3.3.4 Summary of Archival Record Analysis

The 3rd phase of ED data collection and analysis pertained to archival records from Hospital XYZ's IT systems and were attained in incremental steps following validation with senior leadership. A total of three systems were analyzed in isolation and on aggregate. These were the ED's EMR, the "Pre Admit Bed Tracking System", and the inpatient EMR. Our analysis allowed us to validate several findings from the previous phases. Additionally, new insights were gleaned from the validation exercise with senior

[113] Please refer to section 7.3.2.5
[114] Please refer to section 7.3.3.2
[115] The analysis of the inpatient EMR also allowed further confirmation of the existence of an inpatient specialty centrality assigned to specific inpatient service units. Cardiology centralizes its services in 5W, whereas neurosurgery and orthopedics centralize their services in 7C. Additionally, one can confirm that general internal medicine cares for the largest number of patients in Hospital XYZ, that these are distributed across the inpatient service units, and represent the largest portion of 6S. For detailed data from this additional analysis please refer to Appendix IV(iii)

leadership, as well as when considering on aggregate all phases of ED data collection and analysis.

Analysis summary using NREAF views: Our key findings are summarized below while using the NREAF views:

EA Information View

- Fragmented IT systems: data from the 1st and 2nd ED phases were confirmed with regards to the fragmentation of IT systems. Senior leadership, and indeed several 3rd party entities, considered the underlying medical record system as one of Hospital XYZ's strategic assets. However, said system proved to be comprised of several systems, proprietary and homegrown, which weren't integrated.
- Data capture reliability: data capture in the ED had several readily identifiable issues (e.g. a patient being flagged after its departure time) and in some cases these were correlated to the time when the ED was most overcrowded.

EA Organization View

- Organizational climate divide: when presented with data which indicated that the ED's problems also lied beyond its walls, which was contrarily to what was initially described by senior leadership's problem statement, they neither were surprised nor did they object to our observations of varying performance with different inpatient service units. Conceivably one could say, once again, that it was due to the absent end-to-end measurement attributed to the fragmented IT systems. However, a data point from the 2nd Phase (i.e. corporate culture was suggested by ED physicians as an issue) warranted further exploration.
- Local optimization behavior: data from the 2nd Phase was confirmed in terms of ED physicians requesting inpatient beds ahead of time (i.e. ED patients had yet to be flagged) and effectively attempting to locally optimize the system.

EA Process View

- Inability of end-to-end patient flow measurement: the existence of fragmented IT systems prevented senior leadership from having end-to-end patient flow measurement. A key finding was that of there being a considerable difference in the timeliness of the interaction between the ED and different inpatient service units.
- Absent performance measurement: the existence of fragmented IT systems prevented performance measurement practices at an end-to-end level. However, leveraging the ED's EMR system alone allowed us to identify phenomena of interest which senior leadership wasn't aware of (e.g. number of patients leaving without being seen; considerable ED LOS difference from non-admitted patients versus admitted patients; time spent in each ED key process; etc). Similarly, data from the "Pre Admit Bed Tracking System" alone, allowed us to measure the waste of an inpatient bed being unoccupied (i.e. bed clean to bed occupy time). Finally, data from the inpatient EMR allowed us to measure the considerable contribution from the ED to Hospital XYZ (see Strategy View below). Clearly, the narrowness in performance measurement practices weren't only an effect of the fragmented information structure. The ED EMR was undoubtedly constraining in terms of the ability to readily perform analysis on the data. However, the other two systems allowed for Microsoft Excel extracts which are within the realm of Hospital XYZ analysis capabilities.
- Narrow ED process improvement initiatives: senior leadership was thinking of implementing expensive self-service check-ins in the ED which at a minimum would have had little effect on throughput and could introduce other problems as well.

EA Service View

- Hindered ED patient experience: data from the 2nd ED phase was confirmed with regards to patients suffering from more routine and non-urgent illnesses (i.e. acuity level 3) were spending a considerably larger amount of time in the ED. Furthermore, the rate of patients left without being seen was correlated with when

the ED was most overcrowded. One could argue that ED physicians were correct in saying that Hospital XYZ wasn't addressing the needs of its surrounding community to the best of its ability.

- Compromised ED patient flow: data from the 1st and 2nd ED phases were confirmed in terms of the existence of patient overcrowding in the ED and patient boarding in particular (i.e. inability to transfer patients to an inpatient service unit).
- Variable timeliness interaction between ED and inpatient specialties: data from the 2nd Phase was confirmed in terms of the existence of variable performance in the timeliness of the interaction between the ED and impatient service units, which were strongly associated with specific inpatient specialties. Succinctly, 5W was measured as the worse inpatient service unit interacting with the ED, and the vast majority of its patients are from cardiology. In turn, 7C was measured as the best inpatient service unit interacting with the ED, and the greater majority of its patients are from neurosurgery and orthopedics. We also confirmed that general internal medicine is the inpatient specialty which receives the most of the ED's patients, and that these in turn are distributed across all but one of the inpatient service units.

EA Strategy View

- Considerable contribution from ED to Hospital XYZ: data from the 2nd Phase was confirmed in terms of the ED's contribution to Hospital XYZ at several levels (i.e. number of referred patients; total LOS from its referred patients; total revenue charge capture from medically related inpatient services).

Analysis insights guiding further exploration of Hospital XYZ: As noted previously, our findings from archival record analysis were presented all at once in this section for the sake of readability. However, archival record analysis was done concurrently or indeed sequentially with data collection efforts and analysis done elsewhere in Hospital XYZ. For instance, senior leadership was interviewed before any results from archival records analysis were shared with them. Similarly, the extended patient flow analysis

from the ED to the inpatient service units, allowed us to identify and get access to inpatient service units of interest before the inpatient EMR analysis took place. These research flow clarifications are important so as to adequately explain how research progressed from the emerging phenomena of interest, and gradually and iteratively allowed for validation and theory building. Thus considering the key insights from the first two archival record gateways with senior leadership, two emergent phenomena of interest began to crystallize.

Firstly, we began understanding Hospital XYZ's *organizational climate* and how it was embedded differently in different levels of the organization. Organizational climate is "*a summary perception, or global impression, of how an organization deals with its members and environments*" (Ostroff and Schmitt 1993) whereby a positive internal environment, which is receptive of participation and inducing of mutual trust, is thought to result in workers producing more and ultimately increasing organizational effectiveness (Likert 1967). The ED's 1st and 2nd phase of data collection and analysis, together with the results of the ED's EMR analysis allowed us to determine that the ED's problems also lied beyond its walls, which was contrary to what was initially described in senior leadership's problem statement. However, upon being briefed of our findings, senior leadership were neither surprised nor did they object and did in fact acknowledge that they knew of a problem existing with patient boarding due to an underlying difficulty in admitting patients. As such, we had further evidence of a cultural disconnect between the missions of senior leadership at Hospital XYZ and that of ED clinical staff[116] and sought to explore this phenomena in subsequent data collection.

Secondly, the confirmation of a variable timeliness in the interaction between the ED and inpatient specialties prompted further data collection to specifically look at the best and worse performing inpatient service units (i.e. 5W and 7C). Additionally, two other inpatient service units were included, for being the fastest (i.e. 5C was fastest, although it had low volume) and one of the largest recipients of GIM (i.e. 6S). Ultimately, our intent

[116] Please refer to section 7.3.2.5.

was to understand why variable performance was taking place in the interaction between the ED and these four inpatient service units.

The remainder of this chapter will explore these two emergent phenomena of interest by continuing to describe Hospital XYZ's enterprise architecture in other functional areas of the organization (see Figure 7-17). First we examine the Clinical and Administrative Support Services, followed by Senior Leadership, and finally other segments of Hospital XYZ's patient flow. Finally, in the last section we summarize our findings.

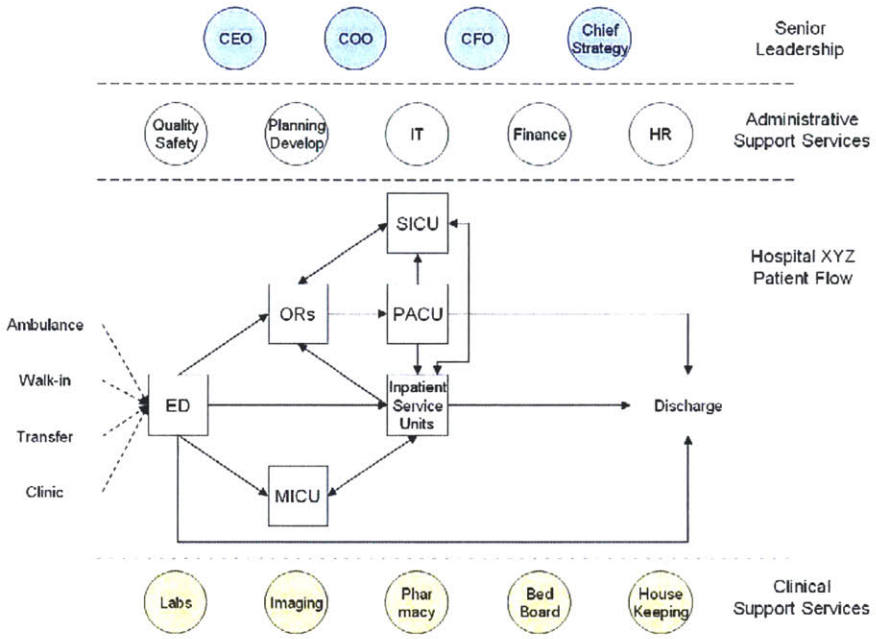


Figure 7-17: Hospital XYZ Organizational Structure

7.4 Clinical and Administrative Support Services Analysis

Having completed the analysis of the ED's EMR, and together with our findings from creating the ED's VSM and interviewing its clinical staff, our research began analyzing the ED's key interfaces with other stakeholders within Hospital XYZ. These can be broadly categorized as Clinical Support Services and Administrative Support Services. What follows is a description of the findings gleaned from each of the two categories while using the NREAF views already enriched with the emerged constructs from our ED analysis.

7.4.1 Clinical Support Services

Clinical Support Services include Hospital XYZ stakeholders that support the ED in providing indirect care for patients (e.g. pharmacy manages drugs that are administered to patients but they don't directly interact with the patient; bed board admissions assign beds for patients; etc). A total of four interviews were conducted (i.e. pharmacy, laboratory, housekeeping, hospital bed board) where two of them allowed for audio recording (i.e. pharmacy and laboratory).[117]

7.4.1.1 Clinical Support Services External / Policy View

The Pharmacy Director offered that one of the reasons that the ED was experiencing overcrowding was that surrounding hospitals had closed doors and their respective patient traffic was reverted to Hospital XYZ. However, even though Hospital XYZ might have considered going on diversion (i.e. signaling to emergency transport services that the ED was full) it wouldn't given the existence of regulatory oversight tracking the number of patients seen in the ED, and that in general the community negatively perceives such diversions.

Further evidence of regulatory oversight surfaced as the Pharmacy Director explained that the ED wasn't allowed to use its normal drug supply procedures when caring for admitted patients that were being held in the ED. In an urgent care scenario patients are administered drugs without need of determining whether or not a patient is allergic to a

[117] For a sample of interview excerpts and focused coding please refer to Appendix IV(iv.a)

particular drug. Conversely, in a non-urgent care environment, prescribed drugs have to be cleared by a pharmacist who checks the patient medical record for potential allergies or potential conflicts with other existing medication, and then decides whether or not to clear a patient for a particular drug ordered by a physician. As such, once a patient is admitted and remains in the ED, regulations require that the non-urgent drug prescribing process be followed. Ultimately, the industry's evolution in Hospital XYZ's geographic area had been such that both the ED and the pharmacy were struggling to cope with regulatory requirements for treating patients being boarded in the ED.

Finally, it was said that the way Hospital XYZ was paid for its outpatient and inpatient services directly influenced underlying care processes. Essentially in an outpatient setting Hospital XYZ doesn't have an incentive to reduce drug costs, as it is able to bill payers at cost with a small margin. In an inpatient setting, the diagnostic related group (DRG) from Medicare and other payers adopting similar payment models, influences the pharmacy to find alternative drugs that help reduce costs whilst not jeopardizing patient care.

> *"The idea there is that you are going to use the least work you can consistent with getting the person out of the hospital with a certain level of care. But you don't want to have an expensive drug used when a cheaper drug would suffice. That is basically the rules."*
>
> Hospital XYZ Pharmacy Director

7.4.1.2 Clinical Support Services Strategy View

The Pharmacy Director supported the ED's clinical staff view that there had been an increase in patient demand as a direct result from Hospital XYZ's growth strategy in highly specialized procedures (e.g. liver transplant).

7.4.1.3 Clinical Support Services Service View

The Pharmacy Director noted that patient overcrowding was having several negative effects on patient experience as well as generating a considerable amount of waste for the hospital. To begin with ED nurses are highly trained and expensive not only due to their training but also because of their salary structure, and yet they are being used to take care of stable patients boarding in the ED (i.e. admitted patients that remain in the ED while

waiting for an inpatient bed). Secondly, the quality of the patient experience is diminished as the patient has to remain in the ED and in a stable condition is better able to sense the nature of emergency care around him. Furthermore, he supported our analysis that patients of a less acuity needing to be admitted were spending a larger amount of time in the ED waiting for an inpatient bed, thus further negatively impacting their patient experience.

Ultimately, Hospital XYZ's service architecture was described as disjointed as a direct result of the way it had been growing, and as a result, communication across the enterprise was gradually becoming a bigger issue, whether it be for normal operational day-to-day matters, or more fundamental system changes.

> *"I would say there is generally a disjointed view of this organization. It is so big that the left hand does not know what the right hand is doing. Communication is becoming a bigger issue than what I am used to. It isn't always an issue but... It is hard to get anything out to everybody. It is hard for everybody to understand where we are going with this or that."*
>
> Hospital XYZ Pharmacy Director

Another contributing factor to an inefficient value delivery of the service architecture, was that of local process optimization behaviors taking place without regard for upstream and/or downstream implications. One example was that of physicians submitting a patient specimen to the laboratory (e.g. blood vial, flesh tissue, etc) with no order printout from the archaic system, and used a hand-written note instead "*please call Dr. ABC*". In essence, physicians were avoiding having to use or manage nurses using the cumbersome archaic ordering system. However, they were adversely affecting the lab technicians as these would have to place additional calls and track them down in order to ask them which tests they wanted done.

7.4.1.4 Clinical Support Services Process View

Hospital XYZ Clinical Support Services exhibited several different ways to perform the same tasks (i.e. lack of standardization) depending on the particular service unit, which

added to the process management overhead. For instance, in terms of laboratory results, every service within the hospital would have to use the archaic IT ordering system and subsequently the pneumatic tube system to send-off a patient sample for analysis. However, whereas the ED would receive direct notification in its EMR system that a lab result was ready and that they could easily access it, other services would have to check result availability in the archaic system. The laboratory was concerned that it wasn't able to check whether or not isolated services (i.e. those whose system wasn't integrated to the lab system) had already checked the status of their results. Therefore it was not only an issue of lack of process standardization but also of process transparency.

At times the existence of different ways of doing things was not necessarily due to an absent standard but rather because individual stakeholders were locally optimizing their processes to improve their productivity. For instance, the previously mentioned lab ordering technique used by some physicians was said to be a clear choice by the physician as he or she could have used the archaic ordering system and follow standard procedure instead. Another example are ED nurses who steal meds from drug dispensing machines in order to build their own stock of medication and use them at their convenience. Such behavior has several negative implications. First, medications are being administered to admitted boarding patients in a non-controlled manner in the ED, which is against regulations. Second, medications are being administered but no billing information is being captured and thus Hospital XYZ isn't paid for administering that drug or providing that service. Thirdly, when medications are stolen from a drug dispensing machine, the machine doesn't "know" that it has less units than it should, thus the pharmacy might think that enough drugs are available, when in fact there aren't, and this might cause an unforeseen supply disruption (i.e. stock-out). Finally, the patient's health might be at risk because of a drug not being available, or because of an incorrect drug being administered (i.e. what regulation was trying to avoid in the first place).

In other cases an inefficient process doesn't necessarily result from an individual's isolated behavior but rather from an enterprise process improvement initiative. As previously noted, the occurrence of ED patient boarding required that a non-urgent

prescribing process be implemented in the ED. Hospital XYZ's process improvement director responded with the installation of expensive drug dispensing machines in the ED that allow for pharmacy to control remotely whether a drug can be administered to a patient or not. However, if the ED's interfacing with inpatient specialties and service units had been addressed and redesigned, such an expensive drug dispensing *bolt-on* wouldn't have been necessary. Also, in addition to the capital equipment investment, there was the additional cost of training the ED nurses on a new system, and requiring them to operate two different drug dispensing processes (i.e. urgent and non-urgent care) which increased the complexity of their work.

7.4.1.5 Clinical Support Services Organization View

Hospital XYZ's history was further referenced when the Director of Pharmacy mentioned that the hospital was run by physicians who had started as a physician group practice and later built a hospital for their purposes. Traditionally, he noted, the reverse happens in that hospitals purchase or contract with group practices and not the other way around. In essence, it meant that a different mindset was in place, one that favored procedure type care, rather than primary care potentially requiring longer patient stays. To that effect, the Pharmacy Director was of the same opinion of ED's clinical staff in that Hospital XYZ wasn't delivering the necessary primary and urgent care services to the surrounding community, and such was causing discomfort amongst clinical staff. However he also conceded that the market environment was particularly fierce and that hospitals in general operated in an environment of very low margins.

Although not mentioned directly, further evidence surfaced pertaining to ED nurses caring for both patients needing urgent care, and those already in a stable condition and awaiting an inpatient bed. Specifically, the implications of caring for such patients in the ED not only contributed to ED nurses' previously mentioned role disconnect[118] but also potentially exacerbated their frustration in having to accommodate additionally complex processes due to regulations and the implemented *bolt-on*.

[118] Please refer to section 7.3.2.5

7.4.1.6 Clinical Support Services Information View

The Laboratory Director described that all services (e.g. ED, operating rooms, inpatient service units) had to use a homegrown archaic system in order to order tests, print them on paper, and then have them subsequently sent to the lab via a pneumatic tube. Conversely, the lab itself had a state-of-the-art off-the-shelf user-friendly system that was considerably more efficient to insert and retrieve information from. In terms of laboratory results dissemination both the ED and operating rooms had the benefit of having results directly sent to their respective EMRs. However, the remaining services would have to rely on the same archaic system which didn't prompt them whenever a new result had become available, and was considerably difficult to navigate. Such was further evidence of the underlying IT fragmentation of Hospital XYZ's information architecture, in that in some services two systems had to be used, whereas in others only one system was used, and that a mix of homegrown and off-the-shelf software solutions prevailed. However, it also demonstrates that the IT user friendliness can impact the timeliness of available information. In other words, the archaic system, although archaic, did allow for test results to be shared between the labs and the inpatient service units, but its difficult user interface prevented users from knowing that new information was available.

An additional effect of the lack of user friendliness of the lab ordering system was that physicians would elect to write orders by hand rather than insert them and print them off the system. Thus, cumbersome technology can in itself be a reinforcing element of the behavior it was originally aimed to replace (i.e. paper-based ordering). A related problem is that the legibility of physician handwriting, which may lead to lab technician error and waste (e.g. new patient samples need to be drawn and tested; patient diagnose delayed; etc).

> *"It is an archaic lab system where it is more laborious to insert the order in the computer than it is to write it by hand."*
>
> Hospital XYZ Laboratory Director

On a similar note, the Pharmacy Director explained that drug prescribing was still done on paper and that Hospital XYZ had yet to transition to an electronic drug ordering

system. One of the reasons offered was that physicians were reluctant and resistant to changing their handwritten process. However, the pharmacist further observed that at times physicians are unable to read each other's hand writing, and that some of the drugs being administered could potentially kill a patient if done incorrectly.

> *"It was interesting because the other day there were 4 doctors trying to understand another doctor's writing. [...] in our world one of these drugs could potentially kill you, therefore we need to move away from the current world [towards more technology solutions] but it is difficult to do that."*
>
> Hospital XYZ Pharmacy Director

Further evidence surfaced pertaining to the importance of having an information architecture capable of supporting both patient clinical information, as well as workflow information. Despite the inpatient EMR being a state-of-the-art software solution, it was deficient in providing real time information as to where a particular admitted patient might be. For instance, in the case of urgent tests where the lab cannot rely on physicians and/or nurses checking results through the archaic system, the lab must call the physician that requested the test. However, not only a shift change might have occurred and the physician is unaware of the test having been requested, but the patient might have also moved to a different inpatient service unit, thus requiring the lab to make several phone calls to track down the patient. To further complicate matters, as time elapses a patient condition might worsen given that the physician doesn't have the required test results that might help diagnose and treat the patient.

> *"Sometimes it is hard to find where the patient is so that we can send the result to them. Each floor will say "we sent him there" then you call here and they say 'we sent them there'".*
>
> Hospital XYZ Laboratory Director

7.4.2 Administrative Support Services

Administrative Support Services include stakeholders that either support Hospital XYZ as a whole (e.g. process improvement engineers) or a set of inpatient services (e.g. medical and surgical services). In both categories data collection consisted primarily of interviews but also included internal documentation and observation. A total of six interviews were conducted with Administrative Support Services and allowed for audio recording.[119]

7.4.2.1 Administrative Support External / Policy View

External and policy related factors are evident throughout the analysis of the Administrative Support stakeholders, who centered their focus on the direct and indirect influence of regulatory requirements and healthcare payers, in shaping their day-to-day activities and hence, the analysis of the remaining EA views.

The enterprise process improvement and planning scope begins first and foremost with the requirements set forth both by regulatory authorities (e.g. Joint Commission) and healthcare payers (e.g. Medicare and private insurance companies). Furthermore, the influence of regulators was also noted amongst nursing staff in that they were aware of national campaigns towards specific issues (e.g. eliminating patient falls; reducing medical errors; etc). The influence of other organizations such as LeapFrog[120] was also recognized however the interviewees didn't give it priority over the requirements of regulators and payers.

The importance of the surrounding community was further noted in terms of Hospital XYZ's requirement towards it, namely having an ED in order to have been able to open doors in the first place.

> *"you have to do what the Joint Commission tells you. The department of public health you have to do what they say. And CMS, government stuff, you have to do what they say."*
>
> Hospital XYZ Process Improvement Project Manager

[119] For a sample of interview excerpts and focused coding please refer to Appendix IV(iv.b)

[120] "The Leapfrog Group is a voluntary program aimed at mobilizing employer purchasing power to alert America's health industry that big leaps in health care safety, quality and customer value will be recognized and rewarded." Leapfrog_Group. (2011). "About us." Retrieved January 22nd, 2011, from http://www.leapfroggroup.org/about_us.

"what [Medicare pay for performance] does force is the organization [chuckle] to declare what are we going to work on improving next year. It helps focus."

Hospital XYZ Quality and Safety Director

"The community would never accept having a tertiary medical center in this area without an ED. They would feel that we weren't meeting the needs of the community."

Hospital XYZ Quality and Safety Director

"All the care that we are supposed to provide and we measure are defined in terms of the core measures. Strict definitions, national definitions, about what you look for, what has to be documented, and what you are supposed to do. Pneumonia needs antibiotics 4 hours, a heart attack needs an aspirin, etc."

Hospital XYZ Planning and Development Director

7.4.2.2 Administrative Support Services Strategy View

The reasoning behind what Administrative Support Services did on a day-to-day basis was often tied to strategy, or lack of it, and in turn, the previously described influence of external stakeholders. Furthermore, the underlying culture of Hospital XYZ was also consistently referred to in explaining the strategic direction set by senior leadership.

The importance of surgical services over other services at Hospital XYZ was clearly denoted by different stakeholders. The Chief of Perioperative Services essentially described herself as "the revenue generator" of Hospital XYZ and said that neither the CEO nor the COO would tell her to cancel elective cases in order to make room for the ED. In turn, the Quality and Safety Director said that the ED "is not the engine" and that senior leadership is reluctant to make investments there. Similarly the Planning and Development Director said that by closing the operating rooms (i.e. surgical services) for a day, she could prove that they are the most important asset for Hospital XYZ.

Hospital XYZ's cultural preference for surgical services was also evident in the scope set by senior leadership for enterprise transformation, as investments were made in additional operating rooms, but not on additional inpatient rooms or the ED. Granted, a

narrow scope of strategic transformation could also speak to senior leaderships' lack of awareness of its service architecture. For instance, the additional operating rooms were completed long before any additional recovery rooms became available.

The end result of Hospital XYZ having both a preference for surgical services and having to offer ED services to the surrounding community, is that daily operations consist of continuous tension amongst services trying to get scarce shared resources, and attempting to make their case in order to influence the bed allocation process. Nonetheless, by default no inpatient bed would be awarded to an ED admitted patient if the ED hadn't reached a sufficiently large state of overcrowding as measured by the Chair of the ED becoming involved. Moreover, hospital operations are adversely impacted by the strategic tension between surgical services and other services.

Finally, the pressure (or revenue generating opportunity) presented by different payers (i.e. both public and private organizations) was such that Hospital XYZ was said to be pursuing too many priorities at a single time, and that a clear strategic focus was absent. So much so that the Quality and Safety Director welcomed pay-for-performance payment models as these would at least narrow down the list of priorities. Moreover, strategic priorities were perceived as a function of requirements set by external stakeholders, which in turn compromised the ability to internally outline clear strategic initiatives.

> *"I am surgical services, the revenue generator for the hospital. I know you have read all the literature where they say that the elective cases should be cancelled so that we can keep the ER moving. That is not the vision. I really think that Dr. [CEO] or Dr. [COO] would come up here saying for us not to cancel elective cases to keep the ER running. If we cancel elective cases we've now lost revenue. So we have a conflict of interests."*
>
> Hospital XYZ Associate Chief Nurse Perioperative Services

> *"That is the part that you may be cautioned about... because I think that the ED in part understands this... It is with some reluctance that there is investment made in that area, because it is not the engine."*
>
> Hospital XYZ Quality and Safety Director

"[The key] asset is the OR, and I can prove that by shutting it down for a day."

Hospital XYZ Planning and Development Director

"Right now [at Hospital XYZ] there is 100 of them! There is so much stuff going on! So I knock on someone's door and I just have to knock louder, be pushy sometimes, and try to get something up on his radar screen. I have asked [Chief of Strategy] many times to tell us what the big seven are."

Hospital XYZ Process Improvement Project Manager

7.4.2.3 Administrative Support Services Service View

As previously noted, senior leaderships' narrow scope of strategic transformation could also be a function of its lack of awareness for Hospital XYZ's service architecture. Similarly, other stakeholders were also said to lack such an awareness or appreciation. To begin with different services were said to work independently from one another and lacked an appreciation for their impact upstream and/or downstream. Additionally, improvement initiatives were described as centered within each one of the services, and that end-to-end oversight committees had proven to be ineffective in the past. Moreover, having an awareness and/or appreciation for the hospital's service architecture would be a desirable characteristic, as would be the involvement of the right people in improvement initiatives to enable change across the hospital enterprise. Ultimately, although at a different level of analysis, these instances are similar evidence of the previously noted narrow scope of strategic transformation exercised by Hospital XYZ's senior leadership.

Finally, we also gained a better understanding of the implications of cancelling elective procedures. From a surgeon's perspective he or she is faced with the complex task of rescheduling a case (i.e. finding another available time in the operating rooms amid existing block scheduling practices). In turn patients will have made personal time commitments as well as undergone psychological preparations to do an elective procedure. Finally, Hospital XYZ itself wouldn't appreciate losing the operating room's setup costs (i.e. each procedure is uniquely prepared for each case), and also potentially lose the patient's payment who would elect to go elsewhere for his or her procedure.

Ultimately, given existing operational constraints and enterprise values the cancelling of procedures at Hospital XYZ is the absolute last resort to accommodate ED overcrowding.

7.4.2.4 Administrative Support Services Process View

In analyzing the Administrative Support Services stakeholders from an EA Process View, further effects of EA View interactions became apparent, and once again these effects reflected themselves at different levels of analysis. Furthermore, specific characteristics pertaining to the EA Process View were identified as having an exacerbating and/or mitigating effect towards each other, thus prompting us to add that layer of analysis.

To begin with, different nursing teams, whether they are staffed in the ED, or in different medical or surgical inpatient floors, were said to adopt local standards which weren't followed at other locations (e.g. the data and order of said data, captured by nurses when keeping patient status for subsequent nursing handoff). The immediate adverse effect quoted was the inability to transfer nurses with the same core level of training to other service units which were struggling with higher patient demand at a given point in time. However, lack of standardization was also said to take place within individual service units themselves, as nurses adopted different ways of doing things (e.g. some ED nurses immediately signaled flow status updates in the ED EMR, whereas others used a batch approach and assigned the same time to several patients at once).

The existence of these localized standardization practices, or lack of them, was contributing to the undermining of Hospital XYZ's enterprise process measurement capability. One example was the prevalence of Microsoft Excel sheets used to track the usage of different Operating Rooms (ORs). Firstly, different ORs used different versions of Excel sheets. Secondly, different surgeons would allow or not access to said Excel sheets.

A similar issue in data sharing occurred in that data was indeed available to non-physician staff, however it wasn't being shared amongst non-physician staff. In other words, content was available but it wasn't being analyzed holistically. At least three different stakeholders, responsible for three different areas, were looking at their own

data and wondering about each others' data. Additionally, the Quality and Safety Director defined her role in the realm of clinical and operational performance, and said that she didn't have access to financial aspects underlying her processes, and in fact had no idea what was the financial contribution of the ED (or any other service). The Director's lack of access to financial aspects might in principle be a way to keep her impartial to the underlying effects of her enterprise process improvement and planning activities. However, as noted in the EA Strategy View[121], the Director's direction is first and foremost set by external stakeholders, rather than a clear internal Hospital XYZ focused strategic plan. Moreover, enterprise process improvement and planning scope follows external prompting, with little or no connection to internal strategy and underlying finances. Finally, and conversely, the Planning and Development Director concerned herself with financial data extracted from the inpatient EMR (e.g. patient volumes, procedure volumes, physician volumes, etc), and didn't see any data regarding operations. Therefore, strategic planning was being based primarily financial data and excluding other performance dimensions.

Finally, our analysis also uncovered undesirable standards in that the *firefighting* of operations had become the norm rather than the exception (e.g. figuring out when the ED would be allowed inpatient beds as opposed to the ORs) and such was causing considerable stress to different stakeholders on a daily basis.

> *"Each nursing area has its own process for different types of orders and that contributes to a silo effect where a nurse only knows how to do things in a given area even when those things are also done elsewhere"*
>
> Hospital XYZ Associate Chief Nurse Med/Surg

> *"Some health plans are beginning to include quality measures into the contracts. I don't do contracts [chuckle] I just worry about performance, so I don't know how much is tied to each measure."*
>
> Hospital XYZ Quality and Safety Director

[121] Please refer to section 7.4.2.2

"Hour by hour we are saying who is going to get what. At that time an email usually goes out saying to discharge all your patients and we just hope that we can keep the ED and the OR going. The physicians aren't involved at all unless I get the impression that we have to cancel a [elective] case."

Hospital XYZ Associate Chief Nurse Perioperative Services

7.4.2.5 Administrative Support Services Organization View

Previously we identified the importance of Hospital XYZ's enterprise history and how it in turn had generated an organizational climate divide between ED clinicians, and indeed those of other services, and senior leadership. The specific point of contention was whether enough was being done in terms of the role of Hospital XYZ's emergency care services towards the surrounding community, and whether or not a focus on elective procedures was undermining that role. With the benefit of the ED analysis as well as the Clinical Support Services, the analysis of the Administrative Support Services revealed further insights into the elements comprising a hospital enterprise's EA Organization View.

To begin with, organizational climate is a phenomenon that can be examined both at an enterprise level as well as lower levels of analysis (e.g. service unit). At an enterprise level one can assess the relative cultural harmony amongst the various stakeholders (e.g. ED, inpatient service units, senior leadership, inpatient specialties) and whether tension exists or not when considering effects beyond a single service unit (e.g. strategic plan to solely invest in additional ORs while the ED wasn't the target of significant investment since its inception). At a service unit level one can assess several factors. First, to what extent the employees of a service unit are receptive towards enterprise leadership (i.e. do they view them favorably). Second, to what extent leadership at the service unit level can influence and ignore enterprise leadership. Third, what are the incentives in place at the service unit level and do its employees generally feel motivated and supported in their activities.

Some of the insights in the previous EA Views for this section can be further contemplated from these refined constructs. The Chief of Perioperative Services

considered her activity as the revenue generator for Hospital XYZ, and reported that senior leadership wouldn't tell her to cancel an elective case. Subsequently, competition for scarce resources was said to exist between the ED and the ORs, and each of them would engage in self-optimization behavior. Another perspective was that different leaders from inpatient specialties were less inclined to share their OR data, and all of them kept it in their own local format (i.e. non-standard and inaccessible by other services). Finally, both ED clinicians and the Chief of Perioperative Services noted that nurses from each area were dissatisfied with their work and were even quitting their jobs. In turn, physicians were said to prefer high-tech surgical procedures over other types of care.

> *"Dr. [X ED Director] and Dr. [Y Surgery Director] report separately to the CEO. I don't think that the CEO tells them where to go. [...] Dr. [X] of course would say "You know just cancel those elective cases Debbie", and you know he would because his important piece is the ED. Dr. [Y] on the other side is the Chief of Surgery is going to say "Debbie we are not cancelling anything. You know what we can sit down and relook at all this but it is a huge job to take a [scheduling] block based system and redo it all". So you have competing high levels because they have vested interests in their own division."*
>
> Hospital XYZ Associate Chief Nurse Perioperative Services

> *"The philosophy at [Hospital XYZ] is that for each individual application we want to get the best software and then afterwards we'll figure out how to tie it all together."*
>
> Hospital XYZ Process Improvement Project Manager

> *"Leadership support for data transparency is very variable across specialties. Department like orthopedics, doctor [X] has been into data for a long time. I would say if there is a grand daddy of data collection at [Hospital XYZ] it is probably doctor [X]. In an access database. It is "their" access database, because that is the right adjective, and published papers with that data. They look at what we are trying to do skeptically."*
>
> Hospital XYZ Planning and Development Director

"Physicians are here to do the high tech really cutting edge stuff. And surgeries are really what generates revenue here and that is kind of the sexy work to do. [...] even among the specialties my opinion is that the surgeon in terms of stature is higher than the other medical specialty. The CEO is a surgeon, the prior CEO is a surgeon, ... [...] generally the operative services generate more revenue than the medical services."

Hospital XYZ Quality and Safety Director

Finally, we elaborated further on modes of coordination so that these highlight not only the importance of boundary spanners (i.e. organizational elements that work across two or more service units) but also of cross departmental management boards. The latter was also captured in the data. However, the lack of senior leadership involvement in such management boards was associated with their poor results and later disbandment.

7.4.2.6 Administrative Support Services Knowledge View

As with the case of the ED Knowledge View analysis[122] we found that Administrative Support Services stakeholders heavily relied on their tacit knowledge in order to mutually adjust whilst managing their competition for scarce resources. Once again, information wasn't codified in any readily available format (e.g. internal policy document) and relied on the Chief Nurses and Charge Nurses of each respective service in order to facilitate patient flow at Hospital XYZ.

Also, whereas before ED physicians had noted that their access to financial data had been denied, several of the Administrative Support Services were also operating with restricted access to information.

Ultimately, when considering the insights from the previous EA Views for this section one can begin to argue that Hospital XYZ has a diminished ability to practice continuous organizational learning. For instance, even in the case of existing data that could inform lean enterprise thinking (i.e. organizational learning principle), such data isn't readily available across different services, and indeed some of them are very territorial about

[122] Please refer to section 7.3.2.6

their data. Another example is the persistence of standards at local service unit level which hinder the aggregation of data and subsequent analysis.

7.4.2.7 Administrative Support Services Information View

The previously identified dysfunctionalities concerning the EA Information View were once again evident. However, we also identified that such dysfunctionalities aren't necessarily readily solvable even if an IT solution already exists.

To begin with we noted the prevailing use of fragmented information systems where each service unit would host its own software (i.e. homegrown and/or off-the-shelf) and elect whether or not to share its data with other stakeholders. Additionally, we further noted that strategic decisions support data was primarily sourced from the administrative data captured by the inpatient EMR. The immediate implication was the non-inclusion of the ED specific data to inform strategic decision analysis. Another implication is that, in terms of Hospital XYZ's own data, the underlying strategic thinking is informed by archival records only pertaining to data required by external stakeholders (i.e. administrative data for regulatory and payer entities). As such, it was further evident that a hospital's information architecture ought to be able to support both patient clinical information (also used for billing), as well as workflow information.

Finally, we also gained a better understanding of the considerable overhead involved for Hospital XYZ to extract information from paper-based medical records, and then insert it into the inpatient EMR for subsequent internal use, and also to submit said data for regulatory agencies, or to file insurance claims.

7.5 Senior Leadership Analysis

Interviews with senior leadership took place at different points during the in-depth analysis of Hospital XYZ, and included the Chief Operating Officer (COO), the Chief of Strategy, and the Chief Financial Officer (CFO). Both the CFO and CSTG were non-clinicians, while the COO was a practicing clinician. A total of eight interviews were done and allowed for recording (i.e. three with the COO, another three with the CSTG, and two with the CFO). The findings presented in this section stem from interviews that took place before senior leadership had access to our ED archival record analysis, so as to minimize the potential for biasing their data. However, the findings themselves already reflect several iterations of analysis both within this section and across sections (e.g. Clinical and Administrative Support Services). As such, what follows is a description of the findings gleaned while using the NREAF views that have been continuously refined with emerged constructs from said sections.[123]

7.5.1 Senior Leadership External / Policy View

The US healthcare system was described as fragmented mainly in terms of providers and payers. The former was often referenced as the *cottage industry* as healthcare providers are mostly practicing in small groups independently of each other and require patients to go through an extended period of time to seek their care from start to finish (e.g. primary care, specialty care, ancillary tests, etc). The latter described the existence of dozens of insurance companies whereby each had a separate contract with Hospital XYZ and paid a different negotiated price for the same services rendered. Notably, the government was singled out for its prospective payment system (i.e. Diagnostic Related Groups used by Medicare) which are based on national averages and don't allow for negotiation. As a result Medicare payments were said to be insufficient and Hospital XYZ had to resort to the known technique of cost shifting, whereby private payers indirectly subsidize Medicare through their larger payments.

[123] For additional interview excerpts and focused coding please refer to Appendix IV(iv.c)

When describing Hospital XYZ's external environment at large, senior leadership referred to several stakeholders, including regulatory, payers (both public and private), providers (both competitors and cooperators), patients (both patients and families), the surrounding community, and vendors. A reoccurring theme concerned the influence and pressure of each of these stakeholders, and how some of them in particular shaped the strategy and other architectural elements of Hospital XYZ.

From senior leadership's perspective, healthcare was different from automotive manufacturing in that a patient was part of the product or service being provided. As such, Hospital XYZ didn't have full control over its processes and had to accommodate the effects induced by patient behavior. Some of the effects mentioned were patients showing up at the ED without any sign of needing urgent care. Additionally, discharge processes were slow mostly because patients didn't have family members available to pick them up. Also, patients were said to be disconnected from the financial impact they had on the healthcare system in general, given that they only paid for a fraction of their care, and the bulk was paid by their healthcare insurance company. On a related observation, patients were considered comparable in terms of their behavior in healthcare versus other industries, in that they followed the strength of brand name and had little understanding of the quality of care being provided to them and what it cost.

The pressure and influence of healthcare payers was evident in several different ways. In general, insurance companies were described as preferring care targeted at the preventive side of medicine (e.g. screening tests; immunization; etc), so that patients remain out of the high-cost hospital care environment. Leadership agreed that such an approach makes sense but not in the context of existing contractual arrangements:

> *"Makes great sense from an overall financial perspective and from a population health perspective. I don't dispute for a second that the best things that we could do are to keep healthy people healthy, keeping them from getting sick, keep sick people from getting any sicker, manage the chronic diseases, those are the two best things that you can do. However when we have these contractual arrangements with insurance companies [...] it is very difficult to make money within health patient primary care practice. That is not*

how we at [Hospital XYZ] make money. We don't make money from our patient primary care. We have a lot of outpatient primary care, but we don't make money from it. We would make more money from specialty care. We make our money from procedures, surgeries, from admissions to the hospital, so exactly the things that the health plans would like to prevent that is what we make our money from."

Hospital XYZ Chief of Strategy

Notably Hospital XYZ's ED is regarded as an outpatient care delivery service, and as such it is also included in senior leadership's notion of services that don't make money. Ultimately, the value proposition of healthcare payers and Hospital XYZ weren't aligned with one another. However, there was one time where the value proposition seemed aligned, and that was in the context of capitation, where Hospital XYZ was paid a flat fee per patient per month, regardless of any costs incurred while caring for the patients. As such, the hospital had the underlying incentive of keeping patients out of the hospital and in as healthy state as possible and to care for them otherwise, rather than have them go to another provider, as Hospital XYZ would be ultimately responsible for those costs also. Similarly, Hospital XYZ had a program in place to closely manage the care of *frequent flyers* (i.e. 1% to 5% of patients that consumed 20% to 30% of resources) and curb their behavior. As a result, Hospital XYZ was able to care for patients at a reduced cost and profit from the capitation model. In the end, the capitation model was not sustained at large in Hospital XYZ's State, and Hospital XYZ went back to being paid on a fee-for-service model (i.e. a contractually agreed price for each procedure with each payer). As a result, Hospital XYZ ceased to offer services focused on preventive care and reoriented its services to a volume based model.

"we would call [the patients] up and work with them to see if we could meet their needs inside [Hospital XYZ] and keep them there. We got rid of those positions now because we don't need them. Capitation has gone away so we no longer have the incentive to keep them here for everything."

Hospital XYZ Chief of Strategy

Several issues are introduced in the context of the fee-for-service model. To begin with, the way insurance companies pay Hospital XYZ (or any other hospital for that matter) has no relationship with the underlying costs of delivering the contractually agreed services. The patient revenue captured is primarily a function of Hospital XYZ's negotiating ability, and different insurance companies value different services differently, therefore making it very difficult to understand which services perform better than others.

> *"One of the things that I seem to struggle with all the time I speak with health plans and they don't get there is the fact that how they pay us holds no relationship to what it costs us to deliver.[...] let us take a look at our department and see who the winners and losers are... it is a function of where insurance companies are putting their money, it is not a function of how well the physicians are performing, or how productive they are, or how efficient they are"*
>
> Hospital XYZ CFO

In the end, Hospital XYZ tries to offer the services that the insurance companies are willing to pay most for. Similarly, Hospital XYZ plans its process improvement initiatives on the areas where each insurance company is focusing its own attention on. Moreover, senior leadership felt that the US healthcare system lacked a sense of centralized direction, and Hospital XYZ responded as best it could to maximize the fragmented opportunities.

> *"at the end of the day we end up having to take wherever the money will come from, and I am certainly not going to say that we don't want all this money to go into inpatient because we are making a profit there and you are not willing to give it to our group practice therefore we will forego it, so at the end of the day we take whatever way we will get it"*
>
> Hospital XYZ CFO

> *"On the cost side, both the employers and the insurers... there is no system of care. As I say, what we have now are random acts of clinical improvement where people decide this year we are going to work on this, this year we are going to work on that, ... there is no systematic approach to healthcare in the United States, either by the government or by*

the healthcare industry, and that is a real problem[...]We are just shooting like a shot gun all over the place and there isn't any systematic rationale."

Hospital XYZ COO

"We have many different goals which has partly confused the improvement effort because the improvement effort can be the same, I can want to improve congested of heart failure in my hospital A, and someone can want to improve congested heart failure at hospital B, but the customer they are doing it for can be completely different. In some cases they don't even know who the customer is, they are just doing it because CMS is not going to pay you unless you get better"

Hospital XYZ Chief of Strategy

"what is happening now is that we have 15 different things that everybody is asking us to do, and they are not all the same, and they are all trying to tie a reward to them in pay for performance.[...] the government is doing it the slightly in the opposite way which says, if you don't report this we are going to pay you a little less"

Hospital XYZ COO

An additional key issue regarding the fee-for-service model, is the level of secrecy surrounding the contractually agreed price for each procedure done by Hospital XYZ. Such secrecy is a defensive mechanism instituted by Hospital XYZ so that insurance companies don't try to pressure them into lowering their price further. In essence, insurance companies have an *acceptable* operating margin in mind for Hospital XYZ, and if they find out that care is being delivered more efficiently, they try to reduce their payments in the next contract renewal negotiations.

"what the government and the insurers want to do is if they pay us [Hospital XYZ] 15K, in order to survive, we figure out how to do it for 10K, once they figure out we know how to do it for ten they lower the reimbursement from 15K to 10K and say that we [Hospital XYZ] are making too much."

Hospital XYZ COO

Finally, leadership discussed the existence of a significant amount of regulatory oversight but that some of it was useful, such as patient privacy laws (i.e. Health Insurance Portability and Accountability Act) and public reporting of clinical measures. Furthermore, Medicare was praised for being the only payer that made explicit contractual arrangements to compensate Hospital XYZ for its teaching mission. Finally, further mentioning was made to the the state's planning commission approving the hospital's construction only on the condition that primary and emergency care components be added to its services.

7.5.2 Senior Leadership Strategy View

At the beginning of this chapter we described Hospital XYZ's history and how senior leadership stated the problem surrounding its ED. Both sections[124] were useful in allowing for an initial understanding about Hospital XYZ's strategy. Furthermore, the immediately preceding section also refined our understanding about the external environment drivers influencing senior leadership's strategic decision making. What follows is a focused description of Hospital XYZ's strategy in terms of key strategic goals, the vision, but also the existence of internal drivers shaping those strategic elements.

The key elements of Hospital XYZ's strategy were said to be built on the following:

- Integrated multispecialty care delivery: all of Hospital XYZ's physicians are salaried and therefore committed to Hospital XYZ rather than a series of different stakeholders as it normally happens even in the largest of hospitals. Additionally, Hospital XYZ is committed to team based care, bringing together multiple physicians from multiple specialties in order to take care of a single patient with multiple illnesses. Furthermore, all the care required by a patient can be delivered at Hospital XYZ thus eliminating the waste of patient movement, scheduling delay, information handoffs, accumulated price markups, etc. Finally, Hospital

[124] Please refer to sections 7.1 and 7.2

XYZ uses a single patient medical record where all relevant patient information is captured.

- Highly sophisticated care: evidence based medicine guidelines were said to be designed for specific diseases rather than people. People have multiple illnesses and thus require customized care, often involving expert knowledge and highly sophisticated treatments from multiple disciplines. Hospital XYZ is a regional leader on several medical specialties and in same cases at US national level also.
- Teaching: Hospital XYZ has teaching programs in all of its specialties. These are still relatively new when compared to those of other institutions that have existed for over a century at least. However, teaching is a fundamental mechanism to build a specialty referral network, as newly trained clinicians who venture into other organizations will refer their toughest cases to their mentors at Hospital XYZ.
- Community hospital alliances: Hospital XYZ has selectively opened its technology to surrounding community hospitals, so as to attract physicians to bring their patients to Hospital XYZ. Conversely, Hospital XYZ also selectively staffs surgeons in surrounding community hospitals in order to teach them how to do the simpler cases, and have them refer the more complex cases to Hospital XYZ. As previously noted, Hospital XYZ's current core strategy isn't centered on primary care services, and thus seeks to complement surrounding community hospitals, rather than compete on their lower margin services.

The core expectation of senior leadership as set by Hospital XYZ's Board of Directors is to continue to grow its operating margin and volume, so that it may be able to continue to invest in the most sophisticated medical technologies, distinguish itself as a provider of excellence in as many subspecialties as possible, and grow its physician group practice in the process. With this in mind it is useful to refer once again to one of the COO's initial observations about Hospital XYZ:

"Our character is specialized care and not to be a community hospital [...] the hospital is an extension of the group practice, as opposed to all the other places where the hospital existed and individual physician practices developed to support the hospital."

Hospital XYZ COO

When the capitation payment model was in place, it prompted Hospital XYZ to acquire existing physician practices in the region and in doing so increase its geographic spread and number of covered lives. The ultimate goal however was to feed the hospital's tertiary care services in order to sustain the number of specialists that were needed to continue to meet their growth aspirations. In the end the model failed for them for three main reasons. Firstly, although care givers were said to be oblivious of a particular patient's health plan, the organization described itself in a *schizophrenic state* as senior leadership was well aware that it got paid less money the more resources that were spent taking care of capitated patients. Secondly, the organization felt that the health plans meddled too much in their affairs and demanded extensive utilization reviews which often resulted in unpaid insurance claims. Thirdly, although the health plan said the organization was responsible for managing the capitated patients, it allowed patients to seek care elsewhere and Hospital XYZ was ultimately responsible for any costs incurred by them at any other facility.

The alternative to capitation was to continue to grow in a fee-for-service model whereby any procedure is reimbursed at a previously negotiated price, and in the process avoid the perverse incentives of cutting patient care costs. In doing so the value of the primary care network was to strictly feed the hospital's tertiary care services and ancillary services such as radiology, laboratory, and so forth. Realizing that patients were only willing to drive 10 to 20 miles to their point of care, leadership decided not to renew their contracts with any community care practices beyond that range from their hospital. Furthermore, the current COO devised a growth strategy centered around key specialties or service lines which were epidemiologically aligned with the needs of the surrounding patient population, and where Hospital XYZ could build a strong reputation of excellence. However, the Chief of Strategy also noted that the surrounding patient population was

insufficient to provide the necessary number of cases for certain procedures (e.g. liver transplants), thus growing a strong reputation of excellence was essential to enlarge the market geographically. Finally, the Chief of Strategy also added that the objective is not only to attract patients to services where Hospital XYZ excels on, but also where they make the most margin from (as noted in the preceding section by all senior leadership).

> *"[Hospital XYZ] is known as a diagnostic center where if no one can figure out what is wrong with you, you should come to the [Hospital XYZ]. And also for tertiary and quaternary care at a very high level surgical as well as medically the excellence of very complicated difficult cases."*
>
> Hospital XYZ COO

> *"We have a lot of outpatient primary care, but we don't make money from it. We would make more money from specialty care. We make our money from procedures, surgeries. [...] So we get paid based on encounters, visits, surgeries, admissions, procedures, colonoscopies, angioplasties, we get paid based on volume utilization and so that is what we count, it is what drives our revenue. [...] our growth priorities are really in those areas of sub specialty expertise where we are and want to remain and grow even stronger as a center of excellence. So we are focused on cardiovascular services, we are focused on neurosciences. [Ultimately] our incentive is to work to attract patients to the services that we excel in and that we make a better margin from and that are really core to our mission"*
>
> Hospital XYZ Chief of Strategy

7.5.3 Senior Leadership Service View

Our analysis far has already made several specific inferences on Hospital XYZ's senior leadership awareness and appreciation of the underlying service architecture. In particular, when analyzing the Administrative Support Services[125] we gathered that the enterprise transformation strategic scope had narrowly focused in building additional operating rooms, but not additional recovery rooms, inpatient rooms, or upgrading the ED. What follows is a specific analysis of Hospital XYZ's senior leadership data with regards to the service architecture EA View.

[125] Please refer to sections 7.4.2.2 and 7.4.2.3

Several aspects emerged consistently once again, and these were service architecture management, extended enterprise management, service sustainability (from a patient and clinician experience perspective), service continuity (from a patient care perspective), and ultimately, service architecture awareness and appreciation.

In terms of service architecture management the COO made a useful distinction between two models of servicing a patient in Hospital XYZ. On one hand, there is the notion of *single build model* where a patient codes (i.e. patient is in a bed and suddenly goes unconscious) and all the necessary resources (e.g. clinicians from throughout the hospital, equipment, drugs, etc) come to the patient's bedside to deal with the specific code. On the other hand, there is the notion of a *sequence model* where the patient moves physically along different key processes, as he or she is being administered the necessary treatments (e.g. blood tests, radiology, operating room, etc) rather than have all the resources come to the patient. With regards to the *single build model*, senior leadership were consistent in saying that everything stops in order to take care of a coding patient, because otherwise he or she may deteriorate considerably (and in the process cost additional resources to treat), or even *expire* (i.e. loss of life). However, with regards to the *sequence model* they noted that the operating rooms (ORs) were "*feeling the pain*" as they were unable to discharge patients at times to the recovery room, who in turn was waiting for inpatient beds. One of the solutions supported by senior leadership was to hold patients longer in the ED in order to allow for extra inpatient beds for the ORs, and also to order additional tests as these are done faster in the ED and would ultimately reduce the patient's LOS as an inpatient. Interestingly, said solution specifically confirms the evidence collected from the ED and the Clinical and Administrative Support Services.

> *"Average length of stay is 4.6 days, including solid organ transplantation, [...] One of the things that we have found is that there is a body of consultation and testing that is part of the ED workup before the patient gets to the floor, and what we have found is that if the patient needs a CAT scan while they are in the ED, through a care process map, or just being in the ED, getting that test done is basically the single build mode. We have great concern that if the goal is to get them on the floor quickly and then order those tests, that then they become in the large queue for the whole hospital with all the other patients that needs whatever and*

in the end the length of stay for that patient in the hospital is smaller. Having the patient doing those tests in the ED really saves us time on the LOS."

Hospital XYZ COO

"The other place that is feeling the pain is the OR. Upstairs is full and the OR backs up. The last thing a surgeon needs to hear is that you cannot do your next case, because we cant get this patient out of the OR, because the PACU is full because no one can be sent upstairs."

Hospital XYZ Chief of Strategy

In terms of extended enterprise management senior leadership explained the previously described strategic alliances with surrounding community hospitals where select technology is made available, as well as Hospital XYZ surgeons who make time to practice in community hospitals. Additionally, Hospital XYZ continues to invest in its teaching program with hopes to build its specialty referral network over time.

In terms of service sustainability, the experience of two separate stakeholders was identified as particularly important, namely the patient and the physicians/surgeons. Clinical staff were said to want Hospital XYZ to support them adequately and in a timely manner in terms of their tools, operating suites, technical personnel, ancillary service support, etc. In terms of the patient, the COO mentioned how their expectations are variable and how they have implemented different services to accommodate them. In the ED there is a *Minor ED* that caters to less acute patients in a timely manner. As for patients seeking specialized care (e.g. heart attack, stroke, etc) they arrive at the ED and are quickly processed and sent to the designated inpatient specialty. Interestingly, all of the patient examples used referred to the need (and hence, contribution) of ED services.

"If I want a stent I might pass through the emergency room and go right up to a cardiac cath lab, I have all kinds of issues about informed consent, about my loved ones knowing what I am doing and where I am going, all this is part of our customer service piece for the patient."

Hospital XYZ COO

In terms of service continuity senior leadership had noted that one of its core strategic capabilities was it being an integrated multispecialty provider. A key element mentioned was the use of a single electronic medical record which adequately captured all the necessary information pertaining to a patient, thereby supporting service continuity. Interestingly, the Chief of Strategy said that they didn't measure patients, and instead measured encounters, meaning that they were unable to identify the number of times each patient had visited Hospital XYZ (and for that matter, which services it had used). Thus, despite having a single electronic medical record, senior leadership didn't leverage it in terms of assessing service continuity. Notably, senior leaders had already mentioned that they were paid on a volume basis (i.e. fee for service) and not a patient member basis (i.e. capitation), and most likely the payment model was affecting the way they leveraged their information system, and ultimately how they assesses their service architecture.

> *"We don't measure patients. We measure encounters. We measure visits to the outpatient clinics by department. We measure visits to the emergency room. We have 36,000 visits to the emergency room per year. I can't tell you that it is 38,000 people, if it is 10,000 people, or if it is 5,000 people. I am certain that we have some frequent flyers who over the course of the year are here 10 times and we have other people who are here once or maybe once every three years, but the point is that we don't measure people. We measure use of our system."*
>
> Hospital XYZ Chief of Strategy

7.5.4 Senior Leadership Process View

In terms of process enterprise measurement capability we previously mentioned how the organization was unable (or perhaps uninterested) to measure patients, and instead it measured its system use. Furthermore, the Chief of Strategy noted that he was unable to measure accurately the financial contribution of those patients living within a 20 mile radius from Hospital XYZ, and those patients willing to travel farther distances to seek subspecialty services at Hospital XYZ.

Meanwhile, the CFO bluntly considered clinical leadership (i.e. CEO and COO) unsuccessful in adequately managing and changing Hospital XYZ's behaviors. Specifically, he felt that clinical leadership was missing the opportunity of further improving Hospital XYZ, and instead opted to side with the physicians.

> *"Leadership has to decide what it wants to do, to help communicate that to the staff physicians, and I don't think they are there. I don't think they are there. I still think the physician leadership still sides with the staff physicians. The administrators may want to provide more transparency, provide more information, try to get these guys to understand what their contribution is or isn't, and that there is opportunity to improve, but we don't have a physician leadership thinking that way. So there isn't a meeting of the minds between the two groups"*
>
> Hospital XYZ CFO

In terms of ED specific performance measurement practices we were reminded that the Chief of Strategy narrowly measured the ED's physician productivity in terms of the number of patient encounters per full-time-equivalent (FTE), and thus felt that the ED could solve its problems by having its existing staff work harder. However, the CFO exhibited similar narrow measurement although from a different perspective. When describing a potential investment to build a new ED, he considered it nonviable as the new ED would be unable to pay for itself, thus clearly disregarding the ED's contribution to inpatient services.

> *"I wonder if there is enough new activity in the new ED to pay for a $25M project. This is a heavy weighted project... I still can't get over the $25M... I have seen the presentation 2 or 3 times and it is not the presentation wasn't good, but when they go away, my mind still says to myself "that is an awful lot amount of money for this amount of space".*
>
> Hospital XYZ CFO

In terms of broader performance measurement practices the COO noted three different content areas, namely evidence-based-medicine, operations process analysis, and operations financial analysis. In doing so he mentioned that three different people had

been assigned to one content area (notably, two of them were the Quality and Safety Director, and the Planning and Development Director, both interviewed as Administrative Support Services). However, although three key content performance areas (or dimensions) were being analyzed, their champions weren't cross-referencing their data or analysis (as confirmed in our interview analysis with them). Furthermore, each champion was report to a different senior leader (i.e. the Planning and Development Director reported to the CFO; the Quality and Safety Director reported to the Chief of Strategy; and the evidenced-based-medicine champion reported to the COO). Ultimately, although multidimensional performance data was being captured, the processes by which they were being analyzed and validated weren't holistic, and thus didn't fully leverage the data's potential.

7.5.5 Senior Leadership Organization View

The analysis of senior leadership from an EA Organization view generated further insight into behavior previously described while identifying further interactions across EA Views. Additionally, several aspects emerged consistently once again, and these were enterprise history and culture, incentives (both individual and hospital), local organizational climate and subculture, and finally, enterprise organizational climate.

In terms of Hospital XYZ's history and culture we have noted how senior leadership considers specialized care as its defining characteristic and thus one of the reasons behind the strategic focus in growing specific subspecialties. However, there are other characteristics also worth highlighting. To begin with, the founder and every subsequent CEO at Hospital XYZ has always been a surgeon, and it is said to remain that way for the future as well. Furthermore, Hospital XYZ defines itself as a physician-led multispecialty group practice, meaning that several of its physicians sit on the Board of Directors which oversees the work of the senior leadership team. All in all, the hospital structure is considered an extension of the physician group practice, as opposed to the more common model where hospitals acquire or contract with individual physician practices.

"the chair is a CEO, and chair will always be a physician. [...] it really is a physician led group practice, and the group practice decides what it needs to take care of the patients that it wants to take care of, and the hospital is an extension of the group practice, as opposed to all the other places in [city centre] where the hospital existed and individual physician practices developed to support the hospital"

Hospital XYZ COO

"Our doctors here are involved in deciding what the strategic priorities of the organization are going to be. In the community hospitals the CEO often times is the business person, and the doctors in the community who have used that workshop are constituencies that they need to keep happy but it is not the doctor's workshop."

Hospital XYZ Chief of Strategy

More broadly, the physician was described as the most important stakeholder in making decisions at Hospital XYZ.

"In healthcare we say that this [his pen] is the most powerful technology in the world because the only person that can get anything done on a patient is a physician, a legal person who can write orders and change things. [...] the physician is directing the care or he is directing someone else to direct the care, whether it is in the hospital in terms of orders, whether it is working up a set of symptoms on a problem you have, or whatever you have"

Hospital XYZ COO

Nonetheless, it is worth recapping that Hospital XYZ was only granted construction approval from the State, with the addition of primary and emergency care services, and thus why the ED was added to the initial floor plans. Furthermore, one can infer from our analysis this far that the ED isn't directly associated with Hospital XYZ's *grassroots* culture, but rather as a necessary requirement for the hospital to come to exist. Moreover, by definition the emergency department is associated with providing primary and emergency care to the surrounding community. Ultimately, senior leadership's disregard for the ED's contribution to its core strategy can also be associated with Hospital XYZ's history and culture.

Another key aspect related to Hospital XYZ's history and culture, is that of the hospital's incentives as a whole. Senior leadership described that it was constantly under pressure to produce financial results and that traditionally leadership changes occurred whenever said results dwindled. As before, one can infer that Hospital XYZ's culture is associated with previously observed phenomena, namely that the core strategy is to continuously grow specialty services that return a higher financial margin.

> *"[Hospital XYZ] hired a new CEO in 1999 as a result of the old one leaving, and he was here for about 6 months, and all of the sudden [Hospital XYZ] started losing money, and so then I became the COO in December of 1999"*
>
> Hospital XYZ COO

> *"there is an internal motivation that we need to get the constant financial pressure, so that we need to do this in order to be able to create a margin and to be able to take care of more and more patients, do it efficiently, do it in a high quality way."*
>
> Hospital XYZ Chief of Strategy

In terms of individual incentives, all clinical staff working at Hospital XYZ is salaried, and thus said to work for the same goal of making Hospital XYZ successful financially, so that they can reinvest capital in new technology and additional space. It was noted however, that being salaried doesn't mean that everyone, and more precisely amongst subspecialties, earns the same salary. Finally, the downside of the salary model was said to be that employees work by the hour and don't have the incentive to be more productive. Also, as the hospital has continued to grow, so have the difficulties of keeping a collegial work environment where everyone knows each other and considers any patient as a "Hospital XYZ patient" rather than a "Dr. X patient".

Instead, subspecialties have begun developing their own organizational climate and subculture where senior leadership realize that they can't solely rely on a service unit's commitment to a project, as the Chair of said unit will only be able to affect what is within his or her own boundary of control.

"The problem is that [Chair of ED], and others, only control what is inside their environment, so he can make that commitment and implement what he can in his environment, but the things that he doesn't control which are probably equally as many things as he does control, he may not be able to implement, if we don't influence it early."

Hospital XYZ CFO

At an enterprise level, and perhaps related to the physician led culture, a related phenomenon is observable in that clinical senior leadership is said to side with physicians and avoid guiding them through necessary changes towards opportunities. In some cases, physicians aren't very receptive of senior leaders and outright ignore their requests.

"The thing that always worries me, from having been here for so long, is that it is so hard to get the commitment of the medical providers to change, that if we get too far down the path, even though we have the simulated models and the concepts designed, and agreement, the rubber hits the road in implementation, and we often find that we can't get there. Part of that is that we are not a top down organization. With 500 physicians it is a consensus building organization. So the CEO might say you know, in the planning process, "absolutely, we are going to do this, and we will make everybody do it, and what a great idea", and what it comes to the end, when the medical staff go "oh we don't really want to do that", the CEO goes "ohhh... okay" [CFO bursts out laughing] and then we have to live with it."

Hospital XYZ CFO

7.5.6 Senior Leadership Knowledge View

Succinct information was shared in terms of evidenced-based-medicine practices and how one physician is responsible for championing their implementation by influencing each specialty. Also, as previously mentioned, Hospital XYZ's expertise in multiple specialties was considered a strategic asset in that evidenced-based-medicine targeted individual diseases, as opposed to people, who have multiple diseases and thus require customizable and specific treatment plans. Similarly, teaching programs were also described in the context of Hospital XYZ's strategic assets, but senior leadership didn't describe them at length. However, a key insight was shared by the Chief of Strategy who

considered that healthcare delivery was so complex that not even his Administrative Support Services had the necessary knowledge about how Hospital XYZ delivered care.

> *"Our finance people, our IT people, our supply chain people, they don't really understand how the delivery system works, and they work at [Hospital XYZ]."*
>
> Hospital XYZ Chief of Strategy

7.5.7 Senior Leadership Information View

Succinct information was shared in terms of the single electronic medical record that Hospital XYZ uses and senior leadership considers part of one of its strategic pillars. Notably, as with previous sections, senior leadership weren't probed directly with regards to each EA View, but the resulting interview data was indeed analyzed through each EA View. As such, in the case of the Information View there weren't many specific insights.

7.6 *Inpatient Service Unit Analysis*

The quantitative and qualitative analysis of the ED[126] determined that a variable timeliness existed in the interaction between the ED and different inpatient specialties. A total of four inpatient service units were selected to explore this phenomenon in detail. The sampling criteria included the best and worse inpatient service units (i.e. 7C and 5W) with the largest patient volume, and the remaining inpatient service units consisted of the largest recipient of General Internal Medicine patients (i.e. 6S) and the fastest unit interacting with the ED (i.e. 5C)(see Table 7-4). More broadly, said units centralized the largest number of patients for four of the top six inpatient specialties, as measured by their financial contribution to Hospital XYZ (see Table 7-5).

Table 7-4: Summary of ED admission timeliness per inpatient service unit

Inpatient Service Unit	# of beds	Bed type(s)	Patient condition sample	# admissions from ED	Elapsed Time
5C	16	ICU / Cardiac Care Unit	Ventilator support and EKG monitoring; intracranial monitoring;	11	2h28
5W	36	Telemetry only	Coronary intervention; electrophysiological procedures; arrhythmia; CHF; angina; MI	94	4h30
6S	18	Medical/Surgical/Telemetry	Back pain; jaw pain; chest pressure	53	4h06
7C	38	Medical/Surgical	Neurosurgery; orthopedics; trauma	50	3h31

Table 7-5: Summary of inpatient specialty contribution assessment

		In relation to Hospital XYZ overall			In relation to Inpatient Specialty		
#	Description	% contrib. patient volume	% contrib. LOS	% contrib. revenue	% ED contrib. patient volume	% ED contrib. LOS	%ED contrib. revenue
1	GIM	26.27%	24.62%	16.74%	86.57%	84.18%	84.07%
2	Cardiology	13.65%	9.32%	17.36%	10.87%	17.15%	12.05%
5	Orthopedics	6.45%	6.00%	7.23%	17.31%	20.63%	15.18%
6	Neurosurgery	5.91%	4.43%	7.08%	8.39%	20.02%	11.66%

[126] Please refer to section 7.3

Ultimately, our intent was to understand why variable performance was taking place in the interaction between the ED and these four inpatient service units. As before our analysis adopted multiple levels of analysis in that we examine each inpatient service unit individually, in relation to the ED, and also in relation to the Hospital XYZ enterprise as a whole. A total of six interviews were conducted and allowed for recording. These included the Charge Nurses for 5C, 5W, and 7C, as well as one physician from 5W and another from 6S, and finally one additional senior nurse from 5W[127].

Figure 7-18 is an overview of our characterization of Hospital XYZ's highest and lowest performing inpatient service units, 7C and 5W respectively, which emerged from the data analysis presented in the next subsections. These characterizations concern both local enterprise architecture characteristics (i.e. pertaining specifically to 7C and 5W respectively) as well as enterprise level (i.e. pertaining to Hospital XYZ as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages the enriched NREAF discussed at the end of this Chapter 7[128]). The circle placement of the EA Views is meant to illustrate that they are interconnected.[129]

[127] For a sample of interview excerpts and focused coding please refer to Appendix IV(iv.d)
[128] See section 7.7.2.
[129] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 7.3.3.2 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions. Furthermore, the colorings of the circles provide a visual indication as to which sub-architecture performed lowest (i.e. red circle) or highest (i.e. green circle).

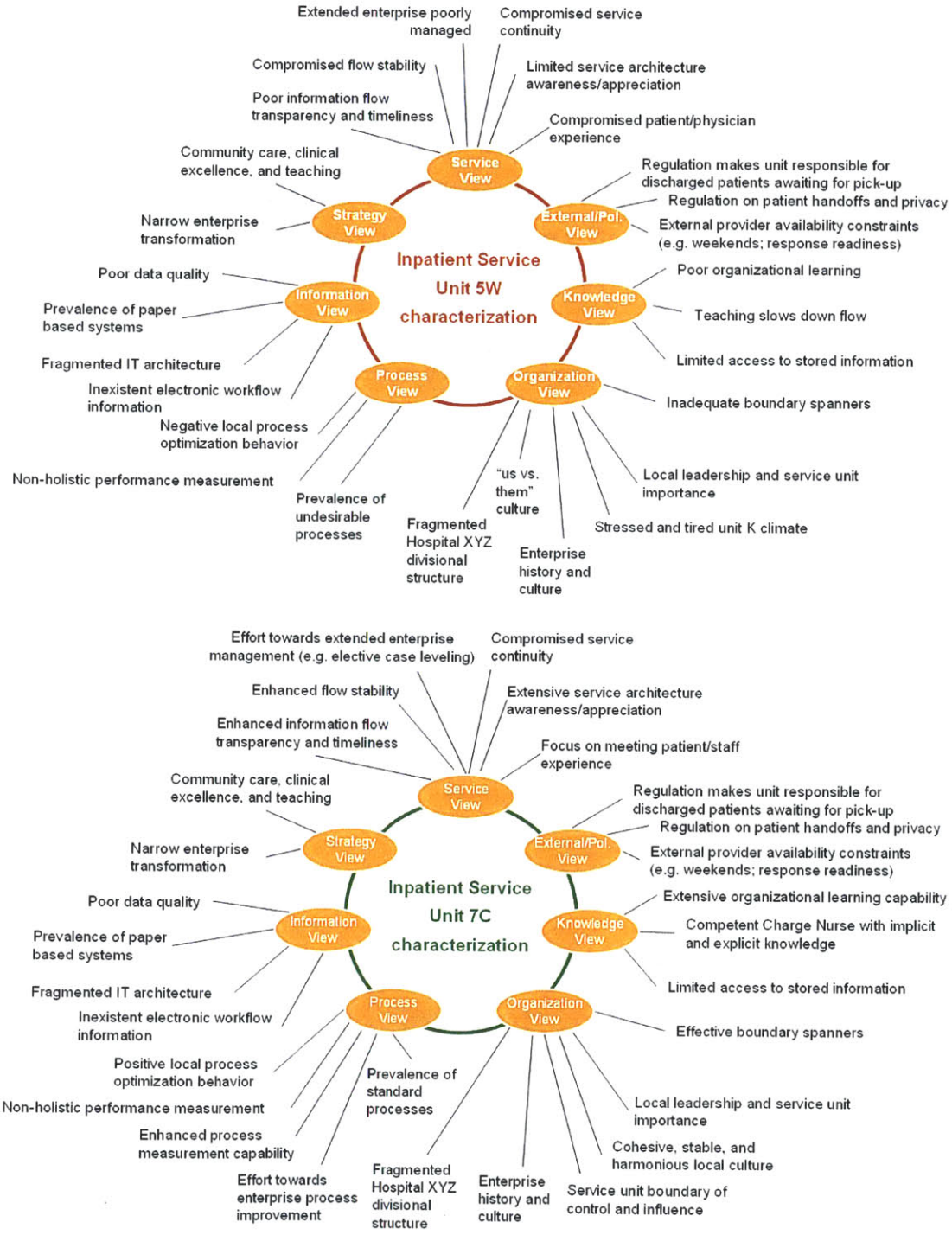


Figure 7-18: Hospital XYZ highest and lowest performing Inpatient Service Units sub-architectures

7.6.1 Inpatient Service Unit External / Policy View

When describing Hospital XYZ's external environment and how it affected the inpatient service units, the interviewees focused their attention on the regulatory requirements and oversight, and in some cases on the interaction with external providers or family members that are responsible for follow-on patient care.

Regulatory requirements had specific implications in terms of the inpatient service units' processes and staffing. For instance, units with more severe patients were required to have a lower ratio of patients per nurse, so that each nurse could dedicate more time to each respective patient. Additionally, nurses mentioned that discharged patients needed to remain in their rooms while waiting for their transportation out of Hospital XYZ., as legally Hospital XYZ is responsible for them until they leave the hospital premises, and thus they are unable to simply vacate the room and place them in a waiting area. Furthermore, several process requirements were consistently mentioned in terms of patient privacy regulation (i.e. Health Insurance Portability and Accountability Act) and patient handoffs within and beyond Hospital XYZ.

Finally, external providers were said to slow down operations in that they might not be open over weekends, or they might take a considerable amount of time to respond to Hospital XYZ nurse inquiries, and all the while patients remain occupying patient beds in Hospital XYZ. Worth noting, is that inpatient service unit 5C has no interaction with external providers as it is an intensive care unit which either services other inpatient service units, or seldom receives external patients arriving through the ED.

Ultimately, the studied inpatient service units were similar in their observations about the EA External and Policy View.

7.6.2 Inpatient Service Unit Strategy View

Interviewees were consistent in describing their contribution to Hospital XYZ's mission in terms of delivering the highest quality of care in the subspecialties that characterize the

enterprise as a leader in the marketplace. However, both 6S and 7C went further and also described their role in supporting the surrounding community.

Several of the observations made by interviewees from 5W reflected the execution of Hospital's XYZ core strategy of growing key subspecialties, and cardiology being one of them. Specifically, nurses shared that they experienced as much as 50% patient turnover every day. Additionally, the cardiology fellow noted that the majority of patients are direct admissions from the clinics, which was in line with Hospital XYZ's business model of establishing a strong referral base for its cardiology services.
The cardiology fellow made several additional observations as to how the enterprise transformations had only focused on building operating rooms (ORs), and ultimately constrained cardiology's ability to function appropriately. To begin with he noted that the number of ORs had been increased but that the number of clinical staff doing admissions and caring for patients had remained the same. In fact, he suggested that increasing the size of 5W wouldn't solve the problem, as it would increase the number of patients that needed to be cared for, and in turn would further jeopardize patient flow. More importantly, he mentioned that there weren't enough recovery beds (i.e. Post-Anesthesia Care Unit) to handle the volume of procedures being done in the Cath-lab.

> *"Increasing capacity up here [in terms of available beds] also increases the work that prevents us from getting down there [to the ED] in a timely manner too."*
>
> Hospital XYZ Cardiology Fellow (5W and Cathlab)

> *"Another bottleneck is our holding area which wasn't designed with enough beds for the number of procedures that we are doing [in the ORs]"*
>
> Hospital XYZ Cardiology Fellow (5W and Cathlab)

A related observation was made by the physician in 6S where he characterized Hospital XYZ's strategy as ineffective as it merely increased the number of beds in 6S and it neither invested in the ED nor did it change the ED's processes.

"Another bottleneck in the ER... we spent a zillion dollars [in building 6S]... the idea was to improve the ER flow but I think it is a silly idea. So what they have done is that they have now increased the volume inside the hospital but you still have a very limited access point, it is a small hole that people still have to squeeze through to get in.

Hospital XYZ Hospitalist Physician (6S)

From the clinical staff in 5W it was clear that a high volume of cardiology patients existed, and that those undergoing elective procedures were competing for beds with patients waiting in the ED. When asked specifically as to who gets the priority in terms of a 5W bed, the cardiology fellow replied:

"The holding area because they are not technically in the hospital. That patient being in the holding area is creating an inability for those 5 cath labs to function, so you have got to get that patient out."

Hospital XYZ Cardiology Fellow (5W and Cathlab)

"This is a very aggressive service line. Which is probably the premiere role model for the institution in terms of efficiency, volume, outcomes, length of stay, you name it... this is a 36 bed unit that on an average day turns over probably 40% to 50% of the patients on any given day. So 56 patients on a given day could come through this unit in terms of workload of the physicians."

Hospital XYZ Charge Nurse (5W)

Finally, reference was made to Hospital XYZ being a teaching institution and that it was an important mission, however it also slowed down ED admissions and other care processes in general.

Ultimately, the studied inpatient service units were similar in their observations about their contribution to Hospital XYZ's mission, although 6S and 7C included both the surrounding community and those patients specifically requiring subspecialty care. Additionally, 5W and 6S described how senior leadership had embarked upon narrow

enterprise strategic transformations, and these had constrained patient flow and care delivery in general.

7.6.3 Inpatient Service Unit Service View

When describing how their inpatient service unit interacted with other stakeholders within and beyond Hospital XYZ, interviewees were consistent on some topics, and exhibited very different approaches on others.

Similarities across inpatient service units: In terms of similarities, all inpatient service units confirmed the rationale of admitting specific patient populations to specific units, as it increases the skill level of the nursing staff and increases efficiency for physicians to round on patients and communicate with nursing staff. All nursing staff complained about housekeeping not cleaning their beds soon enough and therefore either adversely impacting their patient flow or prompting them to clean the beds themselves. Specifically, 5W, 5C, and 7C, described different occasions where they were holding up the PACU because of an unclean bed.

Nursing staff were also consistent in describing service continuity issues in the matter of patients suffering from multiple illnesses and who visited the hospital on multiple different occasions. Hospital XYZ has a single medical record that is updated electronically at the end of each patient visit. However, if a patient has multiple illnesses which require multiple separate visits (i.e. scheduled and/or emergent), Hospital XYZ relies on the patient's primary care physician to keep track of all the visits. As such, physicians from different specialties caring for the same patient, who might have visited the hospital on separate occasions, are unaware of potentially critical health updates that might have taken place since they last saw the patient themselves. An anecdotal episode was shared by one of the nurses whose father is a Hospital XYZ patient:

> *"Every time the patient comes back he starts from the beginning all over again. My father now has 4 doctors. He has leukemia so he has an oncologist. He is a diabetic so he has an endocrinologist. He has a heart condition so he has a cardiologist. And he has severe*

arthritis so he has rheumatoid arthritis doctor. So when something happens with one of the specialties of his healthcare he would like to have all his doctors know about it, so that when he comes back he says "oh you didn't know I had a heart attack 3 months ago and was in the hospital?!!!" [...]I emailed the PCP cardiologist because I know him because I work here, and I also notified the rheumatologist because there were issues with the meds that he was taking that they felt was causing his problem, I just emailed them myself. We called a family meeting... I orchestrated it, the system didn't orchestrate it. I had all 4 physicians sit at the same table and no information had to be repeated and joint decisions could be made."

Hospital XYZ Senior Nurse (5W)

Finally, as noted previously, units 5W and 6S made specific observations as to how senior leadership lacked an appreciation for the service architecture as evidenced by the scope of their enterprise transformation.

"If you can get the power guy, [COO], to actually see really how the whole system is functioning. Give these guys a real big picture overview which I don't think they have."

Hospital XYZ Hospitalist Physician (6S)

Key differences between 5W and 7C: The analysis of inpatient service units from an EA Service View revealed key differences as to how inpatient specialties worked with their inpatient service units as well as with other services. 5W and 7C were found to be similar on several characteristics (e.g. patient severity; number of beds; interaction with ORs/PACU; clinic admissions), and being at opposite sides of the timeliness performance metric, warranted a comparative analysis[130]. Table 7-6 below summarizes the key EA Service View differences between 5W and 7C.

[130] Analysis determined that 5C is a service unit geared towards a significantly more acute patient population in need of ventilators and often times experiencing multiple system failure, therefore requiring *stat* (i.e. priority) patient transfers from other units which would explain its better timeliness in interacting with the ED. Similarly, 6S wasn't included in comparative analysis as it mostly cares for GIM patients (i.e. not associated with Hospital XYZ's core strategy), has little interaction with ORs, and has half the size of 5W and 7C.

Table 7-6: Key Service Architecture differences between 5W and 7C

Characteristic	5W	7C
Physician – nurse communication	Nurses are told last minute patients can be discharged	Nurses told ahead of time when patients can be discharged
Physician – patient communication	Patients are told last minute when they are being discharged	Patients know ahead of time when they should expect to be discharged
Nurse – bed board communication	Initiated by bed board via phone	Physically visit bed board twice a day to discuss flow
Nurse – ED communication	Reactive (initiated by ED)	Proactive (check on ED ahead of time)
Patient admission policy (executed by bed board)	First cath lab patients, then clinics, finally ED	Ongoing negotiation with no preset policy
Medical residents supporting admissions	Afternoon	24 hours

7C

Orthopedics and neurosurgery physicians (i.e. mostly servicing 7C patients) let their patients know ahead of time when they should expect to go home, depending on the type of surgery being done, so that they can make the necessary arrangements to leave the hospital by 10 am on the designated morning. Every morning when physicians round their patients they inform the nurses as to whether a patient has changed status, and can expect to be discharged earlier or later than expected.

Therefore, communication between physicians, nurses, and patients in 7C is such that patients are able to plan ahead (e.g. avoid spending unnecessary time in the hospital; help family relatives plan accordingly; have enhanced patient experience), and nurses are able to manage flow more effectively and maximize utilization (e.g. initiate ahead of time admissions process with ED; initiate discharge documentation ahead of time; manage rehab discharge handoff ahead of time).

Furthermore, communication beyond 7C is facilitated by a proactive approach by 7C nurses. Throughout the day, these engage with the ED over the phone and in person, to get an idea as to what the ED volume looks like and guesstimate how many 7C beds will be needed. Similarly, they visit twice a day the patient bed board which tells them how busy the hospital as a whole looks like, including planned admissions originating from the specialist clinics. In both instances, this proactive approach improves 7C's understanding of what is happening elsewhere in the pipeline and allows them to prepare

accordingly. Finally, attending physicians had the support of medical residents (i.e. house staff) throughout the day, which allowed for ED patients to be admitted at any time of the day.

5W

Unlike 7C, the cardiology physicians servicing 5W patients don't communicate discharge information ahead of time neither with patients nor with nurses. As a result, as many as 30% of patients are said to be unnecessarily occupying beds whilst awaiting for a family relative to pick them up. Similarly, nurses admit that they are unaware of planned discharges and are thus unable to better manage the flow not only with the ED, but also with the cardiac care unit (i.e. 5C) and the PACU. Additionally, the patient daily turnover (i.e. 50%) is busy to the extent that nurses feel unable to communicate beyond 5W unless responding to requests initiated by external stakeholders. Finally, physician cardiology fellows don't have the support of medical residents in the morning, and find themselves spread thin running consult services and admissions on their own.

> *"We are at 98% capacity [in cardiology] that even if someone wrote orders downstairs [in the ED] they would still be there for 6 hours until someone up here gets to go home. So that kind of makes other things mute."*
>
> Hospital XYZ Cardiology Fellow (5W and Cathlab)

7.6.4 Inpatient Service Unit Process View

In our ED analysis[131] we noted how most inpatient specialties had the *right of first refusal* where they can disagree with the ED's patient diagnosis and advise them to admit the patient to general internal medicine (GIM). The one inpatient specialty that doesn't have such a right is GIM. Most likely for this reason, the hospitalist physician in 6S complained that the ED's evaluations were superficial and often required additional tests. However, the physician also conceded that it was physician dependant, in that some ED physicians consistently called for the hospitalist too soon, whereas others did a more thorough workup to begin with. In essence, no standard process was in place as to what

[131] Please refer to section 7.3.2

should feature in a GIM patient admission from the ED, and hence, there wasn't a preset information requirement as to when one could call for admission. Ultimately, one could argue that the ED felt pressured to reduce its overcrowding, and given that GIM couldn't refuse its patients, ED physicians would call upon them ahead of time. Moreover, the ED was also exhibiting localized process optimization behavior.

> *"The ER people who feel that it is essentially their job to decide admit or discharge and then pass it on to us, feel that that accelerates the movement of someone on the floor because they called us sooner, so that we can get their sooner, so that we can get them out of the ER sooner. But it is just the converse because we go down there and we find that treatments that need to be done now haven't started yet, you need more acute evaluation, etc. It actually slows everything down contrary to what their belief is"*
>
> Hospital XYZ Hospitalist Physician (6S)

Key differences between 5W and 7C: As before, we specifically compared inpatient service units 5W and 7C and once again found that they had key differences that further refine our understanding as to why they have opposite timeliness performance whilst interacting with the ED. Table 7-7 below summarizes the key EA Process View differences between 5W and 7C.

Table 7-7: Key Process Architecture differences between 5W and 7C

Characteristic	5W	7C
Discharge performance tracking	Not available	In operation for a year
ED admissions performance tracking	Not available	Variable
Physician rounding debriefing for nurses	Not available	Every morning
Discharge times	Throughout the day (no preset policy)	Policy to discharge all patients by 10am
Admissions capping	Variable	Only if beds not available
Nurse behavior	Nurses hold-beds to avoid new admissions	Bed holding closely supervised and contained. Also, nurses cover for each other to take verbal report from other units.
Bed board behavior	Patients assigned unclean beds (against policy)	Patients assigned clean beds
Admission and discharge leveling	Not available	In operation for several years

7C

Orthopedics and neurosurgery physicians instituted a series of policies to improve their local performance. First, they have nurses fill out a survey sheet for every patient, where discharge information is captured in terms of the discharge day, discharge time, and if their discharge was late. If the discharge was late they need to indicate why (e.g. delayed family relative; unavailable rehab facility; etc). Second, they engaged the ED to conduct a joint survey assessing their performance admission in terms of the type of patient (e.g. orthopedics or neurosurgery), the time the first ED call for admission was made, the time when an ED nurse gave her report, and finally the time the patient arrived. Third, every morning when physicians finish their patient rounds, they engage the nurses and let them know each patient's status in terms of likely discharge date. Fourth, discharges are planned to take place every morning by 10am, so as to allow for new patients to be admitted still in the morning, both from the ED and the clinics. Fifth, attending physicians rely on nurses to let them know whether or not medical residents are capping admissions (regardless of patient source) when beds are still available. Sixth and seventh also concern curbing staff behaviors to ensure patient flow. Sixth, the Charge Nurse keeps a close eye on nurses who might be *holding on* to a bed, which essentially means that a nurse doesn't register a patient discharge immediately, so as to avoid getting sent another patient right away. Another nurse behavior is that 7C nurses have a policy of covering for each other when needed in order to take report from nurses from other service units, and thus avoid holding up a patient admission simply because the originally intended nurse wasn't available. Finally, physicians have in operation for several years a conscious leveling of the number of clinic admissions and expected discharges, so that these don't differ considerably on any given day.

Ultimately, it is important to note that localized process optimization behaviors such as the ones described in 7C, aren't necessarily non-desirable. The referenced policies follow best practices and either solely impact 7C or involve external stakeholders to attain alignment.

5W

Unlike 7C, the cardiology physicians haven't instituted policies towards tracking performance (e.g. discharge or admission) or towards sharing information with nurses at specific times (i.e. end of patient rounds). Similarly, patient discharges can happen at any time of day, and so can medical residents capping admissions (i.e. no longer accepting patient admissions even though beds are available[132]). Furthermore, as a result of 5W nurses holding on to beds, the hospital bed board would assign them patients even when their beds weren't yet clean. Earlier interviews with the bed board revealed that this was indeed the case, and that they did so as they didn't feel that 5W was as responsive as it should be. Finally, there wasn't a conscious effort towards leveling patient clinic admissions with the number of expected discharges[133].

7.6.5 Inpatient Service Unit Organization View

The analysis of inpatient service units from an EA Organization view generated further insight into behavior previously described while identifying further interactions across EA Views. Additionally, several aspects emerged consistently once again, and these were local organizational climate and subculture, modes of coordination, and finally, enterprise organizational climate.

In terms of local organizational climate each of the inpatient service units were consistent with regards to their occupancy levels and associated workload. They were similarly consistent in their evaluation of senior leadership's enterprise transformation plans, and in particular their poor assessment of its service architecture awareness (i.e. series of investments targeted at narrow segments such as only building additional ORs). Finally, as noted previously, nursing staff complained about housekeeping adversely affecting operations and not understanding the seriousness of their actions.

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[132] Another reason for admissions capping is if an inpatient service unit is understaffed in terms of nursing. Thus, beds might be available, but not enough nurses are on a shift to cover for the state regulated patient to nurse ratios. However, no such ratios are set by regulatory authorities for patient to physician ratios. Such ratios may be applied at the discretion of the hospital provider who sets an enterprise wide policy or allows for each medical specialty to set its own policy. Evidently, cardiology had a capping policy in place whereas orthopedics and neurosurgery didn't.

[133] Notably, cardiology has a considerable number of elective procedures which could warrant leveling, and should there indeed be an emergency case, it can always be referred through the ED (as is currently the case).

"I don't know that house keeping have a grasp as to what implication they have... I still can't get over it... it is just mind blowing."

Hospital XYZ Charge Nurse (7C)

In terms of modes of coordination all inpatient service units were consistent in baseline admissions coordination mechanisms. For instance, any inpatient specialty physician responsible for admissions would visit the ED in order to check on a patient and determine whether or not to admit them to their service. Similarly, each inpatient specialty rounded on its patients in the early morning and exchanged patient information between physician shifts. However, we have also highlighted specific differences pertaining to each inpatient specialty and inpatient service units. Succinctly:

- The majority of 6S patients is GIM, and hence only requires a medical resident to process ED admissions, without any involvement of a senior resident, or a fellow, or an attending physician.
- Cardiology adopts the most layered hierarchy as part of its medical training requirements, whereby every ED admission involves at least three physicians (i.e. resident, senior resident, fellow) if not four (i.e. the additional attending physician).
- Orthopedics and neurosurgery adopt a medium layered hierarchy as part of its medical training requirements, whereby ED admissions can be processed by two physicians (e.g. resident and senior resident), with follow-on co-sign by an attending physician within 24 hours of admission (i.e. patient can be admitted to 7C pending attending's signature).

Further analysis revealed that modes of coordination are also influenced by the local organizational subculture, and these were distinctively different in 5W and 7C in particular. For instance, 7C nursing staff spoke very positively of their relationship with all levels of orthopedics and neurosurgery physicians, as evidenced by their daily debriefing policy after morning patient rounds. Conversely, 5W nurses complained that physicians weren't interested in holding joint debriefings. Furthermore, orthopedics and

neurosurgery physician leadership was particularly proactive and took it upon them to improve their processes and service architecture (see Table 7-6 and Table 7-7). Similarly, 7C's Charge Nurses took it upon themselves to visit the ED and the hospital's patient bed board in order to have a better sense of patient flow requirements. Moreover, 7C's subculture was geared towards continuously improving patient flow within and across its boundaries.

Finally, the inpatient service units were consistent in their appreciation of the ED's difficulties with overcrowding, although their underlying position towards the ED varied and denoted a heterogeneous organizational climate at an enterprise level. Specifically:

- 6S was visibly the most critical of the ED and felt that they were limited in their understanding of the patient flow, and in terms of their impact on inpatient operations.
- 5W acknowledged its adverse impact on the ED but had a clear policy towards first accommodating elective cases.
- 7C was sensitive towards the ED and made visible efforts towards improving and sustaining their interaction with the ED.
- Finally, 5C was mostly empathetic towards the ED being fully stretched and doing its best to accommodate patient volume.

"The ER issue just frustrates the hell out of me! Their view [ER] is a limited. We work both in the ER because we are going down there picking up the patients that are in the ER, dealing with the evaluation issue and then bringing them up here. Whereas their view they don't see what happens up here. They really don't. They are very isolated as to what they see. They see first contact and that is it."

Hospital XYZ Hospitalist Physician (6S)

"at least in the emergency room they are on a stretcher and they can keep them there if they need to, but if they are in the cath lab and they are done, they need to come to a bed."

Hospital XYZ Charge Nurse (5W)

"Orthopedics and neurosurgery just got to the point that "you know what, we have got to do something because we want our patients to get on their floor".

Hospital XYZ Charge Nurse (7C)

"[ED] staff is stretched taking care of other things, and they have to wait for a window when they can free themselves up to be actually able to bring the patient up."

Hospital XYZ Charge Nurse (5C)

7.6.6 Inpatient Service Unit Knowledge View

Interviewees were consistent in describing their use of *care pathways* which follow evidenced based medicine and consist of standardized care practices that are considered to be the most adequate for a given type of treatment.

"Pathways are a good idea. We have a lot of pathways here. You have different people rotating through on the inpatient service, people who don't always do it all the time, and when you don't do something all the time you are not necessarily as good as it. You don't remember what you should be doing. So I think that clinical pathways lead to better quality of care"

Hospital XYZ Hospitalist Physician (6S)

Previously, we noted that Hospital XYZ's senior leadership was concerned with only being able to rely on what subspecialties could control within the boundaries of their individual departments[134]. However, as per orthopedics and neurosurgery's example, an organizational learning capability was being developed within and beyond inpatient service unit 7C. Evidently, a service unit's organizational learning capability is not only related to senior leadership's influence and support, but also, and perhaps more importantly, local physician leadership.

Finally, we had already discussed the knowledge transfer requirements of each subspecialty's medical residency programs, and how these affected patient flow. However, we also uncovered the training requirements of nursing staff, and some of the implications of nursing staff's experience and vocation. Succinctly, training new nurses

[134] Please refer to section 7.5.5

was said to impact team work (i.e. less experienced staff are focused in getting their things done, and less available or knowledgeable to help others), impact relations with physicians (e.g. inexperienced nurses aren't as efficient in gathering the necessary information for physicians, and they are less likely to ask questions, or even disagree with a physician).

7.6.7 Inpatient Service Unit Information View

The analysis of inpatient service units from an EA Information view further validated the constructs previously defined in the analysis of the ED, and Clinical and Administrative Support Services. Additionally, the analysis further refined our understanding of how other EA Views are influenced and in turn may influence the EA Information View.

In terms of information systems integration the inpatient service units described a high degree of fragmentation for which there were several contributing factors, and in turn considerably affected other EA Views.

To begin with, an individual inpatient service unit is able to share information with other inpatient service units via the enterprise EMR (i.e. MediTech). However, said system isn't integrated with the ED's EMR (i.e. T-System). Integration between the two systems is enabled by paper printouts and verbal communication. Specifically, when a patient is transferred from the ED to the designated inpatient service unit, its bed carries with the patient's paper medical chart together with a printout from the T-System. Additionally, as required by law, a verbal nurse report is done between an ED nurse and an inpatient service unit nurse. However, both the paper and verbal report mechanisms are non-ideal integration enablers as they are error prone, require additional human intervention, and may potentially delay patient care. Inpatient nurses were reportedly unable most times to ask additional questions of ED nurses, as these were too busy and used available time to simply repeat the information that already existed in the T-System.

"Half the time it is so busy down there [in the ED] that the nurse giving report doesn't even give you time to ask questions. If we had the tsystem information prior to the nurse giving report it would make the handoff a lot more efficient."

Hospital XYZ Charge Nurse (7C)

The fragmented EMRs have an immediate adverse effect on a patient's experience, as he or she is required to repeat all the information that was already given in the ED. Notably, having patients repeat information is in some cases useful towards ensuring their safety (e.g. asking date of birth and patient name before administering a drug). However, for the purpose of an ED transfer handoff, patients at times become frustrated with nursing staff and refuse to cooperate in their care.

"down in the ED that patient has been asked by the initial assessment doctor, the nurse that received him, any consult physician that comes in to the room. They can be asked 2, 3, 4 times the same story, then guess what, they come up here and I am going to start again [chuckle], the admission doctor up here is going to start again [more chuckle].[... patients say] "you know what, I am not going to answer you any more. I have already given you this information. It is somewhere in this hospital. I am done repeating it. Please leave me alone". Patients are tired."

Hospital XYZ Senior Nurse (5W)

Another effect from the fragmented EMRs was the creation of paper-based surveys which were local to each inpatient service unit (i.e. non-standard) and used to construct an initial patient assessment. Essentially, each inpatient service unit had its own version of what information was regarded important from the ED's nurse verbal report, as well as from interviewing the patient, and in what sequence, format, etc, it should be codified. Notably, some service units also used said paper surveys for inpatient transfers (e.g. between cath-lab and 5W). Finally, upon discharging patients, said paper surveys were trown away, as nurses didn't have time to record them in the patient's paper medical chart. By time nurses meant translating the information into a format that was understandable and appropriate for subsequent readership by other medical providers or legal authority (i.e. fear of potential malpractice suits stemming from nurse paper survey).

"A lot of these papers that you write that transfer from unit to unit is not something that you are going to save, it gets lost, it is not part of the permanent record."

Hospital XYZ Senior Nurse (5W)

Information systems fragmentation was further persistent within the inpatient service units, as evidenced by the nurses having to operate multiple software applications at once and on separate machines in order to request and access information (e.g. labs, imaging, etc). We should add that the software programs although fragmented were almost in their entirety state-of-the-art off-the-shelf solutions (with the exception of the lab archaic homegrown ordering system). Ultimately, ongoing information systems transformation efforts were themselves regarded as narrow and further reinforcing the existing systems fragmentation.

"I have been sitting on this EMR committee for a while, and giving advice on how to do things, and somehow it came out that there is no big picture plan, they eventually are going to put together 5 or 6 separate systems and try and knock them together somehow. Everybody has this little microscopic little view of things and they are not seeing the big picture. They are totally missing it."

Hospital XYZ Hospitalist Physician (6S)

Finally, as with Clinical and Administrative Support Services[135] we noted that inpatient service units found their electronic information systems insufficient in terms of the underlying workflow information conveyed. Inpatient nurses expressed an interest in being able to know *what is coming* without having to phone anyone or rely on someone either phoning or paging them. In the case of inpatient service unit 7C the absence of a workflow capability was even more apparent. To begin with, the Charge Nurse would, twice a day, physically visit both the hospital patient bed board and the ED to get a sense of what the patient volume looked like, as she was unable to access either of their systems. Additionally, orthopedics and neurosurgery physician leadership instituted a paper-based survey in order to track 7C's discharge performance, as well as its interaction with the ED. Physicians had engaged with Hospital XYZ's IT staff and

[135] Please refer to sections 7.4.1.6 and 7.4.2.7

learned that their required workflow information was neither captured nor could it be easily implemented into existing systems (i.e. and thus the paper survey). Similarly, the same physicians, or rather, the Chair of Orthopedics, created a homegrown Microsoft Access database to keep track of OR start times, turnaround times, stop times, reasons for delays, etc. Moreover, as previously noted, the orthopedics and neurosurgery physician leadership had a predisposition towards continuously improving patient flow, and in the absence of a capable Hospital XYZ information architecture, they would implement their own information systems (paper and electronic) to that effect.

7.6.8 Multiple Internal Architectural Configurations and Hospital Enterprise Performance

Hospital XYZ's inpatient service units had different levels of performance in their interaction with the ED. Two of these inpatient service units were at opposite sides of the performance spectrum, as measured by the timeliness in transferring patients from the ED to each respective unit. Furthermore, ED clinical staff subjectively assessed said inpatient service units as such, namely 5W as the worse performer, and 7C as the highest performer. Notably, as previously mentioned, we verified their subjective assessment by not only triangulating their responses, but also through comparison with our quantitative analysis of electronic information systems[136]. At an enterprise level both inpatient units services centralized inpatient specialties (i.e. cardiology at 5W, and neurosurgery and orthopedics at 7C) which were high revenue generating flagships for Hospital XYZ. Additionally, the ED's contribution to both service units, as measured by % of total hospital inpatient revenue and % of total-length-of-stay, was comparable. Finally, both inpatient service units had the greatest number of beds in Hospital XYZ and were comparable (i.e. 36 and 38). Moreover, the different ED performance interaction for these two comparable inpatient service units, beckoned explanation for said phenomena, and prompted further exploration. A close examination of the qualitative and quantitative data on these two inpatient service units in particular, uncovered both similar and different architectural characteristics.

[136] Please refer to sections 7.3.3.2. and 7.6. for an overview of our quantitative results.

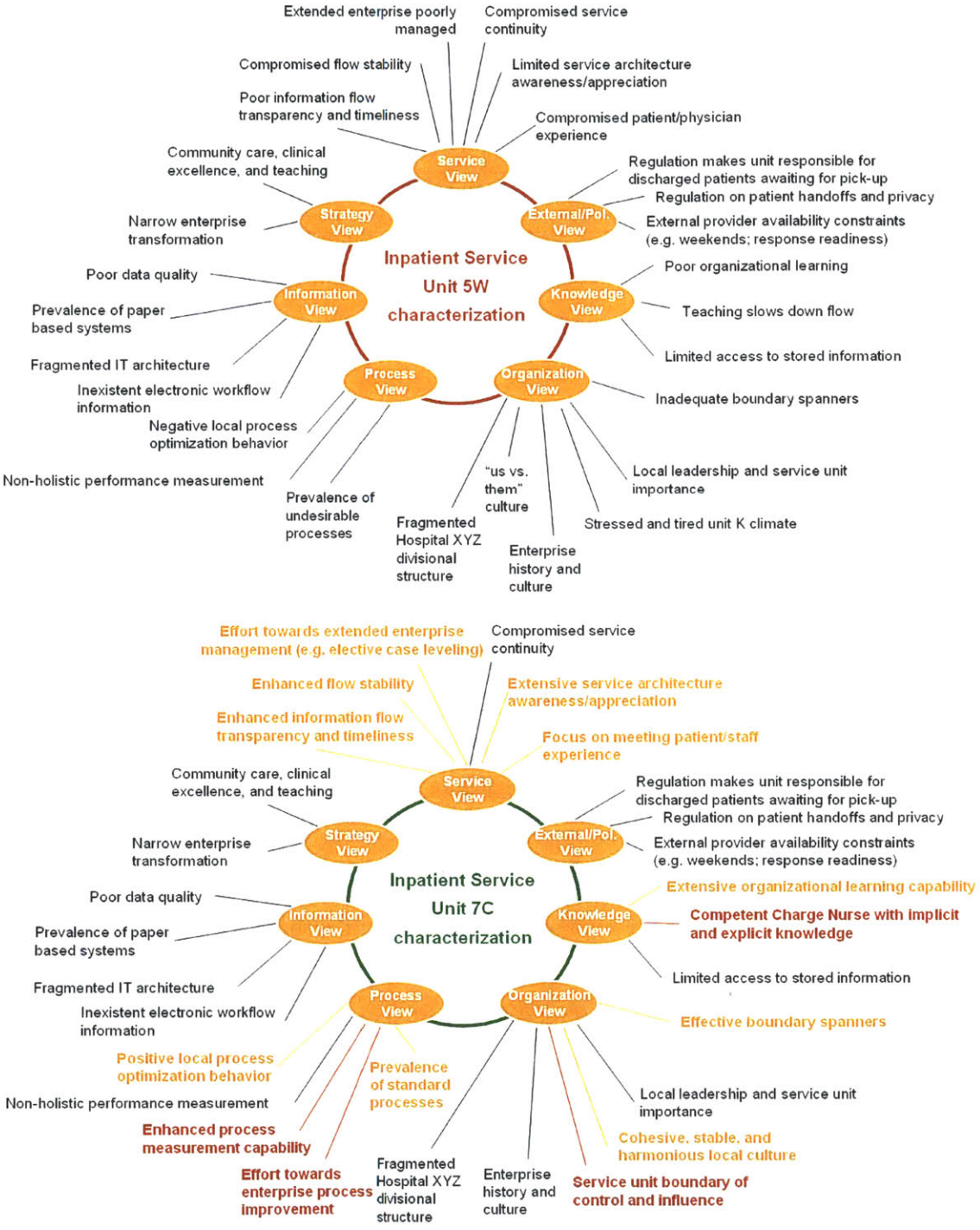

Figure 7-19: Hospital XYZ highest and lowest performing Inpatient Service Units sub-architectures

Figure 7-19 is the overview of Hospital XYZ's sub-architecture characterizations for inpatient service units 5W and 7C, which were presented earlier[137], and pertain to the analysis of the previous subsections. These characterizations concern both local enterprise architecture characteristics (i.e. pertaining specifically to 7C and 5W respectively) as well as enterprise level (i.e. pertaining to Hospital XYZ as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages the enriched NREAF discussed at the end of this Chapter 7[138]). The circle placement of the EA Views is meant to illustrate that they are interconnected.[139] The coloring of the elements in the figure is a visualization technique to readily compare the sub-architectures to one another. Specifically, black denotes no change between sub-architectures; from the Main ORs sub-architecture; red denotes new elements in sub-architecture 7C, which weren't present in 5W; orange denotes elements which are of a similar type but with different properties.

Similar external characteristics included the oversight of regulatory authorities as well as the impact of other external stakeholders. Additionally, the information architecture was similar in terms of its underlying fragmentation, which required the manipulation of multiple software applications, and more fundamentally, prevented the direct communication with the ED's EMR. Finally, both service units shared their assessment of Hospital XYZ's strategy in that it had followed a narrow enterprise transformation scope, and its teaching mission was important but had the adverse effect of slowing down operations.

Conversely, the two inpatient service units had considerable differences in terms of their service architecture, processes, organization, and knowledge. On one hand, cardiology being the highest revenue generator for Hospital XYZ, enabled its local leadership to focus on elective cases, and to regard the ED as their buffer, or as a means to support

[137] See section 7.6
[138] See section 7.7.2.
[139] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 7.3.3.2 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions. Furthermore, the colorings of the circles provide a visual indication as to which sub-architecture performed lowest (i.e. red circle) or highest (i.e. green circle).

their operations (e.g. order additional tests; delay admitting patients; etc). In fact, there was evidence that Hospital XYZ's senior leadership was aware, and also supported these policies. The communication amongst senior physicians and nurses in 5W was poor, and nurses had not only been denied regular debriefings with physicians, but were also very careful, or even fearful, in their interactions with physicians. All in all, 5W concentrating the majority of cardiology patients, was a reflection of cardiology's predisposition towards clinics, and the cathlab, while remaining at an arm's length from other service units, and the ED in particular.

On the other hand, neurosurgery and orthopedics were equally high revenue generating flagships for Hospital XYZ but had decided to institute policies that were different than those of cardiology when managing elective and emergency cases. 7C provided for a safe environment where clinical staff of all levels felt that they could engage with others to ask for help or even to question decisions. Moreover, nurses and physicians worked very closely together and valued each other's contribution to the delivery of care. Clinical staff was better able to manage patient expectations and behaviors (e.g. positive patient interactions; planning discharge pick up; etc) which in turn improved operations and the quality of care. Furthermore, local physician leadership was proactive towards streamlining processes with the ED. Notably, clinical staff in 7C was also proactive towards continuous improvement, and regularly sought process improvements in their operations, while being mindful of other services in Hospital XYZ.

A notable insight from this comparative summary is that 7C follows practices that observe lean enterprise principles, whereas 5W is focused on a narrow approach that tends to generate suboptimization and compromises Hospital XYZ as a whole. It can, therefore, be concluded that *multiple internal architectural configurations* may exist within a single hospital enterprise, and that these in turn generate different levels of hospital enterprise performance, where performance is measured as a multidimensional construct, both in terms of dimensions and stakeholders. Specifically, a specialty and/or hospital generating high revenue by focusing on elective cases, while pressuring or indeed neglecting emergency patients, and in doing so affecting stakeholders within and

across the hospital enterprise, isn't in line with the practices of a lean enterprise. However, the reverse behavior whereby the needs of elective and emergency patients, as well as those specialties servicing them, are addressed in a transparent and balanced manner, are in line with the practices of a lean enterprise, and more capable of delivering higher hospital enterprise performance.

All in all, we established that unlike Hospital XYZ's inpatient service unit 5W (i.e. worse performer), **the inpatient service unit 7C had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream**.

7.7 Enterprise Architecture Discussion

Senior leadership's initial problem statement attributed the ED's problem of overcrowding to there being fewer ED's available in the area, and to Hospital XYZ's salaried model which induced a shift mentality amongst clinical staff. Senior leadership clearly explained that Hospital XYZ's strategy was to grow but that it had no interest in doing so in its ED. As such, senior leadership's desired goal was to be able to do more with the existing resources in the ED (i.e. "how to speed flow in the ED?"). What began as an exploratory research of the ED, gradually progressed to other parts of Hospital XYZ, as we realized that the issues of overcrowding had contributing factors beyond the ED's functional boundary.

In this section we aggregate our findings presented previously for the different embedded units of analysis, namely the ED, the Clinical and Administrative Support Services, the Senior Leadership, and the Inpatient Service Units. In doing so we conducted within and cross case analysis of each of these embedded units, and empirically and theoretically enriched MIT'S NREAF, followed by descriptions of dominant EA View interactions which emerged from the data, as well as revisit our finding that hospitals may be comprised of multiple internal architectural configurations which embed different levels

of understanding of the hospital's overall enterprise architecture, and ultimately make decisions that have different levels of impact on hospital performance.

This section is divided in three subsections. First, we summarize our findings pertaining to the ED, which leverage both the qualitative and quantitative data collected from various parts of Hospital XYZ. Second, we then describe our enriched version of the NREAF, now comprised of 24 main categories and 53 subcategories that emerged from the analysis, and characterize in detail each EA View (i.e. External/Policy; Strategy; Process; Organization; Knowledge; Information; Service[140]). Third, we describe Hospital XYZ's overall EA while leveraging our enriched version of the NREAF and explicitly identifying the key EA View interactions which help explain the enterprise's performance and lean enterprise principles in place. As part of our EA View interactions analysis, we also present our multiple internal architectural configuration construct while describing the two polar inpatient service units (i.e. 5W and 7C) with regards to their interaction with the ED.

7.7.1 ED Main Findings Summary

Quantitative and qualitative analysis determined that senior leadership's initial problem statement was largely inaccurate in that the means to solve the ED's overcrowding didn't lie only within the ED, and that the ED was in fact contributing to Hospital XYZ's core growth strategy. The following is a summary of the main findings directly pertaining to the ED:

- The ED was struggling with patient overcrowding largely because of patient boarding. Non-admitted patients required on average 4h09 to be discharged from the ED, whereas admitted patients required 7h52. Specifically, admitted patients spent almost 3h30 waiting to be discharged from the ED after being flagged for admission by an ED physician.

[140] The nature of the service industry, and that of hospital care in particular, whereby patients are an integral part of the process of care (i.e. don't consume a hospital product per se), rendered that MIT'S NREAF original version of "Products/Services" be referred to only as "Service".

- Emergency care for the surrounding community was being compromised. The ED was taking a considerably long time to care for acuity level 3 patients (i.e. 5h00 for non-admitted, and 8h30 for admitted). As many as 5% of the ED's patients are leaving without being seen by an ED physician. 72.2% of those patients are acuity level 3.
- The ED was contributing to Hospital XYZ's strong financial performance. 24% of the ED's patients were admitted to the hospital and contributed to over 50% of Hospital XYZ's total length of stay. Additionally, patients admitted from the ED went on to contribute 35.1% of Hospital XYZ's total revenue charge capture from medically related inpatient services.
- The ED's clinical staff felt neglected by senior leadership and by specific inpatient specialties as well (i.e. cardiology). Conversely, two inpatient specialties were praised for their behavior and interaction towards the ED (i.e. neurosurgery and orthopedics). Quantitative data analysis confirmed that this was indeed the case, as measured by the timeliness of their interaction and admission of ED patients. Furthermore, our interviewees and observation of each respective inpatient service unit, further verified the ED's clinical staff assessment of inpatient specialty behaviors towards the ED.

7.7.2 Empirically and theoretically enriched NREAF

A close examination of the 34 interview transcripts presented in the previous sections, together with the archival record analysis of Hospital XYZ's fragmented information systems, and the literature review of chapters 2 and 3, gave rise to a total of 24 main categories and 53 subcategories which enriched the characterization of MIT'S NREAF[141].

Notably, several other constructs for each of the EA Views emerged from the data. However, these were either aggregated into the finalized list of constructs or removed entirely if they weren't sufficiently illustrated in the evidence. Moreover, the derivation of the main and

[141] Please refer to Chapter 5 for a detailed description on how the main and subcategories for each EA View emerged from qualitative and quantitative evidence in the course of exploratory case research. Furthermore, please note that our enriched version of the NREAF also reflects the learning from the in-depth case study done on Hospital ABC presented in Chapter 8.

sub categories (see Figure 7-20 and Figure 7-21) followed the literature's recommendation of keeping frameworks simple enough to support effective decision making (Porter 1996; Rhodes and Nightingale 2008).

As noted in Chapter 3[142] this research adopted an enterprise diagnostic mindset and held no pre-conceived notion of organizational element interactions including strength and direction. Such an approach reflects the described nascent phase of EA theoretical development and allowed for the iterative improvement of our understanding and characterization of each of the EA views both individually and holistically while comparing and contrasting empirical results within and across cases. As such, Figure 7-20 and Figure 7-21 have the EA Views ordered alphabetically. However, subsequent analysis of Hospital XYZ's overall EA and in particular the interactions across its EA Views, culminates in the description of dominant interactions which help explain the enterprise's performance and whether lean enterprise principles were being followed.

[142] Please refer to section 3.5.

Figure 7-20: Main Categories of Enriched NREAF

	Main Category	Sub Category
External/Policy	• Industry history and context	
	• External stakeholder value requirements	• Regulatory requirements and oversight • Surrounding community oversight • Payer system influence and pressure • Provider referral influence and pressure • Provider competition • Patient behavior and impact
Information	• Information systems integration	• Data reliability (insertion / visualization) • Information timeliness • Information systems organization and integration
	• Hospital enterprise information systems	• Prevalence of paper information systems • Electronic workflow information system • Electronic medical record
	• Information systems sustainability	• Information systems user friendliness • Information capability upgrades
Knowledge	• Learning organization capability	• Nurturing of enterprise knowledgeable employees • Intra and inter service unit learning
	• Knowledge codifiability and transferability	• Implicit and explicit knowledge • Information transfer mode
	• Information retrieval and access	• Information retrievability • Information access privileges
Organization	• Enterprise history and culture	
	• Enterprise organizational climate	• Enterprise cultural harmony • Senior leadership acceptance by internal stakeholders
	• Service unit organizational climate and subculture	• Local organizational climate • Leadership and service unit enterprise importance • Psychological safety • Workforce stability • Individual and divisional incentives (financial and beyond) • Local organizational culture (silo vs enterprise) • Boundary spanners (role and support)
	• Modes of service unit coordination	• Cross departmental and service unit management boards • Service unit boundary of control and influence • Team familiarity • Role definitions and organizational structure
Process	• Process measurement capability	
	• Holistic performance measurement	• Holistic performance content • Holistic performance process
	• Enterprise process improvement and planning	
	• Process standardization and transparency	• Prevalence of undesirable processes • Local process optimization behavior • Process complexity and flexibility
Service	• Service architecture awareness/appreciation	
	• Extended enterprise management	• Referral network management • Patient and family management • Supplier management
	• Service architecture management	• Modes of clinical coordination (single build/ sequential/ network) • Service sustainability (patient and employee experience) • Stability and leveling of flow • Flow information transparency and timeliness
	• Service continuity (patient lifecycle care)	
Strategy	• Enterprise strategy elements	• Strategic goals • Vision • Enterprise metrics • Business model
	• Enterprise awareness and appreciation	• Enterprise capability • Enterprise contribution
	• Enterprise strategy alignment	• Strategy portfolio alignment
	• Enterprise transformation scope	• Information systems strategy • Human resources strategy • Service architecture strategy • Enterprise strategy scope

Figure 7-21: Subcategories of Enriched NREAF

The following are brief descriptions of each of the 24 main categories identified:
External / Policy EA View: *Industry history and context* provide background information as to the industry as a whole progressed in its multiple dimensions (e.g. payment models, regulatory reform, medicine evolution, etc), as well as in the enterprise's particular context (e.g. regulatory requirements have evolved differently in different US states). *External stakeholder value requirements,* reflects the stakeholders that were most prevalent in our study of seven hospitals in Massachusetts, as well as with various stakeholders within Hospital XYZ and Hospital ABC.

Information EA View: First and foremost the categories reflect information held in information systems in general, as opposed to only technologically enabled solutions. As such, it recognizes that *hospital enterprise information systems* consist of electronic medical records, as well as a considerable quantity of paper-based records. Notably, a distinction is made between clinical and workflow information systems, as several state-of-the-art electronic medical records, including that of Hospital XYZ, were found to be geared only towards captured patient related information, and not support workflow analysis and management. *Information systems sustainability*, concerns the effort required from the end-users manipulating such systems, as well as the cost in maintaining and upgrading them. Finally, *information systems integration* reflects the degree of integration of the underlying IT architecture, as well as with the paper-based information systems, which ultimately impact the information systems organization and integration, as well as the timeliness of information availability, and the data reliability.

Knowledge EA View: Both implicit and explicit sources of knowledge are addressed in the identified categories, and in particular in *Knowledge codifiability and transferability*, as different types of knowledge require different mediums of transfer. *Information retrieval and access* reflects the ease of retrieving information that has been codified into knowledge, and whether or not such information is accessible to everyone within the enterprise. Finally, *learning organization capability* specifically captures the 7th lean enterprise principle and embodies it in terms of existing enterprise mechanisms that nurture employees who are knowledgeable at an enterprise level (i.e. as opposed to a

limited functional level), as well as ongoing improvement efforts that cross individual service unit boundaries.

Organization EA View: *Enterprise history and culture* provides specific background enterprise information that helps understand contemporary enterprise behaviors (e.g. enterprise origin; key historic events; performance trends; etc). *Organizational climate* is analyzed both at an *enterprise* level and a *service unit* level. At an enterprise level, the relationships between service units are considered, as well as how they perceive and accept senior leadership. At a service unit level, a series of dominant interrelated subcategories are identified. For instance, a troubled service unit (i.e. poor local organizational climate) may be struggling with absenteeism or employees quitting their job (i.e. poor work stability), if their underlying incentives aren't being met (e.g. caring for critical patients as opposed to stable patients). However, divisional incentives are equally important to consider, as these also help explain a service unit's internal behavior, as well as its relationship with other service units and/or divisions. Furthermore, a service unit's leader may hold considerable importance in the enterprise (e.g. key revenue generating subspecialty) which allows him or her to shape a subculture which may or may not be aligned with that of the enterprise as a whole. A key construct to that effect is that of *psychological safety* (Edmondson 1999)which describes to what extent different stakeholders feel safe in interacting with others, and in particular, with those who are hierarchically superior (e.g. physicians and nurses). Finally, *modes of service unit coordination* reflect mechanisms in place (e.g. boundary spanners, committees, teams, role definitions) to help facilitate the interaction amongst service units. Specifically:

- Boundary spanner is a construct described in the literature (Leifer and Huber 1977), and characterizes those individuals who facilitate key information beyond the boundary of their particular service unit. However, in a hospital context the term needs further refinement. Specifically, hospital operations rely on care givers to share information via their information systems, in person, or through some other means, whenever they execute a patient handoff or carry out a patient consult. However, boundary spanners are individuals who systematically and proactively engage with other service units in order to support information and

patient flow across the service architecture (i.e. not just because it is the end of a shift or because they need to transfer a patient).

- Cross departmental and service unit management boards are mechanisms that facilitate communication across service units, enable transparency, encourage accountability, share lessons learnt, and devise solutions that consider the service architecture as a whole, rather than only a segment of it. The management board should encourage the sharing of lessons learnt and assess whether or not these make sense to replicate, and in what order, across the hospital service architecture.
- Service unit boundary of control and influence evaluates what is within or beyond an individual service unit's capability to change.
- Team familiarity is a construct described in the literature (Huckman and Pisano 2006; Huckman, Staats et al. 2009) and which emerged consistently from both in-depth hospital case studies. Essentially it evaluates the level of familiarity amongst team members, and it establishes a correlation with performance (i.e. surgical teams that are stable, get to know each other better, and tend to perform better than teams that aren't as stable).

Process EA View: *Process standardization and transparency* considers the baseline complexity and flexibility of existing processes (e.g. admitting a patient; ordering a lab test; rescheduling an elective case; etc), as well as the existence of undesirable processes which have become standard over time (i.e. *firefighting* standard broken processes). The existence of local process optimization behavior (e.g. ordering beds too soon; discharging patients at a regular time; etc) isn't necessarily an undesirable practice, and is a particularly key construct when analyzing EA View interactions. Similarly, *enterprise process improvement and planning*, reflects enterprise level initiatives (as opposed to local optimization efforts) which are also key when analyzing EA View interactions. The two remaining constructs are related to the initial two. *Performance measurement capability* speaks to an enterprise's baseline ability to measure its performance both within and across service units. In turn, *holistic performance measurement* considers the content and process of performance measurement practices. Such distinction is key in determining whether or not hospital enterprise performance is being measured.

Service EA View: Two constructs address the inflow and outflow of patients specifically, and the 4th lean enterprise principle in particular (i.e. internal and external enterprise interdependencies). These are *extended enterprise management* and *service architecture management*. The former one addresses stakeholders that have a direct impact on the patient flow, both in terms of receiving and discharging patients. The latter includes subcategories that reflect the 5th (i.e. stability and flow), and 4th (i.e. effectiveness before efficiency) lean enterprise principles. *Service continuity (patient lifecycle care)* embodies the 1st lean enterprise principle (i.e. holistic approach) where patient experience and quality of care are assessed throughout the patient's lifecycle, as opposed to individual visits to a particular provider (i.e. predominant model today). Other implications are related to this last subcategory and will become more apparent when discussing EA View interactions. Similarly, *service architecture awareness/appreciation* first emerged from answering this thesis' first two research questions, and embodies several lean enterprise principles and offers a means of further understanding EA View interactions. In effect, a hospital's service architecture is comprised of several service units (e.g. emergency department, operating rooms, laboratories, etc) which function with varying levels of interdependence amongst them. Such interdependence may imply sharing scarce resources and/or producing services to support another service unit. However, a hospital's service architecture shouldn't end with a consideration for its internal service units and should also include its interactions with external stakeholders. Ultimately, in the presence of an adequate service architecture awareness/appreciation, an enterprise, a division, or indeed an individual, make decisions that reflect not only local context but also that of others upstream and downstream in a given service architecture.

Strategy EA View: *Enterprise strategy elements* describe the core of the hospital enterprise's strategy (i.e. strategic goals, vision, enterprise metrics, and business model). The remaining three constructs are specific assessments of the enterprise strategy(ies) in place, as per lean enterprise principles. To begin with, determine whether or not the portfolio of strategies in place are in alignment, or if conflict exists among them. *Enterprise awareness and appreciation* ascertains whether or not the contribution of each service unit, as well as their joint contribution and capability, are adequately accounted

for by senior leadership and reflected in the enterprise strategy(ies). Similarly, *enterprise transformation scope* emphasizes the importance of evaluating enterprise strategy(ies) in terms of the projects and planned investments, and how these address the EA Views of Information, Organization, and Service.

7.7.3 Hospital XYZ Enterprise Architecture

Having described the empirically and theoretically enriched MIT's NREAF, what follows is a description of Hospital XYZ's overall EA, as well as the dominant EA View interactions which help describe the enterprise's performance and extent of lean enterprise principles in place.

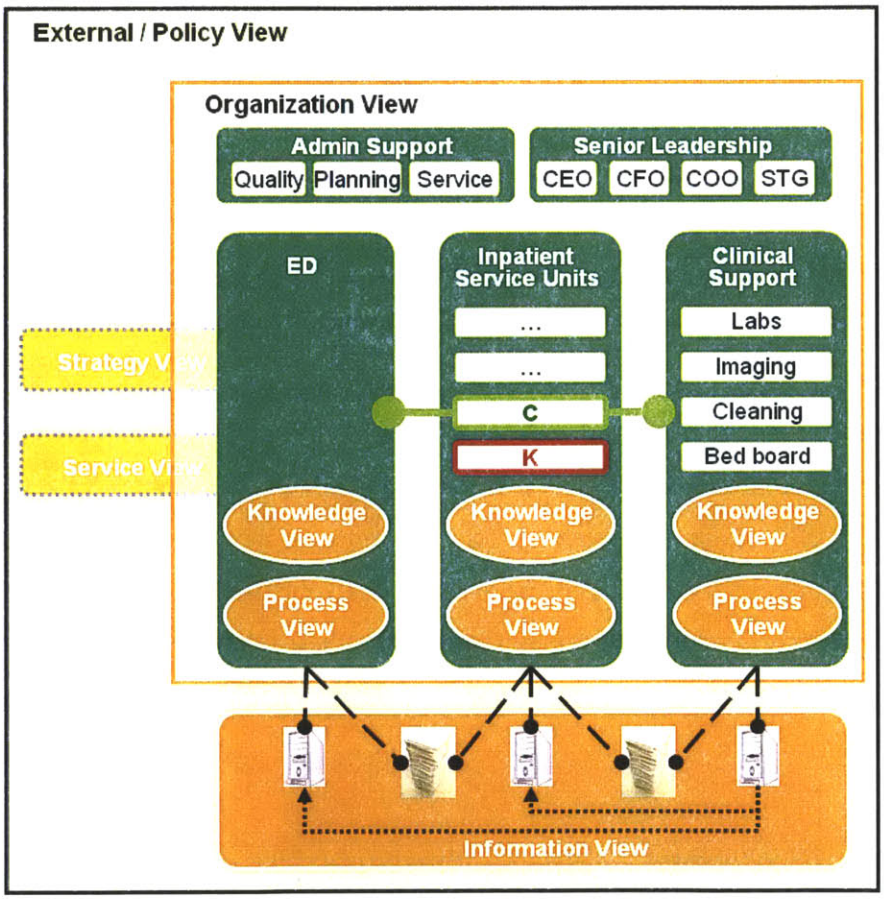

Figure 7-22: Hospital XYZ Enterprise Architecture

Figure 7-22 was derived in the context of our exploratory research which included multiple stakeholders, within and across multiple enterprise levels, and studied multiple dimensions of performance[143]. What follows is a two-part analysis of Hospital XYZ's EA. The first characterizes each EA View separately, whereas the second explores in greater detail the dominant interactions amongst EA Views specifically.

7.3.3.1 Hospital XYZ EA View Analysis

Hospital XYZ External / Policy EA View

From a Policy/External EA View it is clear that Hospital XYZ is strongly influenced by its external stakeholder value requirements, and those of regulatory and payer entities in particular. There is no doubt that the state's requirement that Hospital XYZ offer primary and emergency care services, as part of its building rights approval, was a key event of external policy intervention, and one which had rippling effects on the enterprise (as will be explained in EA View interactions).

On a more operational daily basis, the key regulatory entities consistently mentioned were the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the Center for Medicare and Medicaid Services (CMS). The former is responsible for the accreditation of healthcare organizations in the US, and commonly conducts surprise inspections to Hospital XYZ, and hospital in general, in order to determine whether or not they are up to standards. JCAHO's accreditation allows for Hospital XYZ to service the needs of CMS which represents the US government as a payer of healthcare. Other types of external policy stakeholders were consistently mentioned (i.e. Leapfrog) but these weren't associated with significant pressure as they didn't have regulatory authority and only mildly influenced behavior with their performance prizes on specific clinical metrics.

In terms of payer entities (i.e. insurance companies) Hospital XYZ serviced as many as 82 different payers in 2006, and the most dominant ones (including CMS) visibly pressured and influenced Hospital XYZ in a variety of ways. To begin with, different

[143] Please refer to chapter 2 section 2.3 for a detailed description on each of these elements.

payers required that different metrics (i.e. clinical process metrics) be tracked and reported on, if Hospital XYZ wanted to be eligible for insurance claims reimbursement. Additionally, different payers paid different prices for different services offered by Hospital XYZ, and indeed exercised different levels of bargaining power, whereby no direct relationship existed between what Hospital XYZ got paid, and what it cost to provide a given service.

Worth noting is Hospital XYZ relationship to a nearby reputable medical school, as part of its teaching hospital mission, and which earns Hospital XYZ additional revenue from CMS (i.e. the hospital's indirect medical education factor is 6.7%, which means that each DRG payment is added that % from baseline value[144]).

Finally, surrounding hospitals had closed their doors in the recent past, and thus less ED beds were available in general in the region. However, the large city center hospitals were beginning to more aggressively expand their geographic reach, and in doing so were increasing their competitive pressure on Hospital XYZ. Such pressure was not only direct in terms of attracting patients themselves, but also indirect in terms of the bargaining power they exercised over Hospital XYZ provider referrals (i.e. surrounding community hospitals).

Hospital XYZ Information EA View

Hospital XYZ's senior leadership considers its single patient medical record as one of the core capabilities underlying its strategy of delivering integrated multispecialty care. Hospital XYZ does indeed have state-of-the-art software systems in various parts of the organization. However, the key problem is that these software systems aren't integrated with one another, and most notably, the ED's system doesn't communicate directly with the inpatient electronic medical record. Valuable information exists in the fragmented IT architecture, and was indeed leveraged in this research, however, ready access to such information isn't available, and would either require prohibitively expensive in-house

[144] For a detailed explanation on Hospital XYZ's DRG payments please refer to Appendix IV(ii)

software programming capability, or paying equally expensive software vendors to upgrade their default built-in reports and forms.

Furthermore, although state-of-the-art electronic medical records were in place, albeit fragmented, neither of them readily captured and/or enabled visualization of workflow related data. In essence, said systems are offered as the industry standard and reflect a focus on patient related data, and capturing charges for subsequent billing of Hospital XYZ's services rendered to each particular patient. As a result, the prevalence of paper-based information systems (e.g. surveys, performance sheets, etc) is further reinforced, and in turn, further exacerbates the information systems' fragmentation. Additionally, in the absence of real time workflow information, employees had to compensate by seeking alternative ways of attaining the same information.

Finally, some of the electronic systems in place were indeed integrated and supported effectively different service units. However, integration alone proved to be insufficient, as the existence of arcane cumbersome systems induced users to once again seek alternative ways of attaining the same information.

Hospital XYZ Knowledge EA View

One of Hospital XYZ's core capabilities is the provision of team based care stemming from its multiple medical and surgical specialties, which allow it to provide high quality care to patients suffering from multiple illnesses. To that effect, evidenced-based-medicine practices are beginning to be pursued on a service unit individual basis. However, different service units developed different mental models as to how to run their individual operations, therefore, knowledge became highly embedded and specific to each service unit.

Additionally, the previously mentioned electronic medical record would supposedly provide a single point of information to assist in the delivery of care. However, clinical staff members found it difficult to retrieve real time previously captured patient related data, and resorted instead to redundantly asking for said information once again.

Similarly, in some cases valuable information existed within Hospital XYZ, and was known by a particular stakeholder to be the case. However, said stakeholder would consistently be denied access to the information (e.g. ED physicians enquiring about their financial contribution; clinical and administrative support staff wanting access to OR databases; etc). Notably, the lack of access wasn't a function of the information systems fragmentation, but rather a distinctive access privilege decision made by the owner(s) of the desired information.

Finally, Hospital XYZ exhibited an organizational learning capability at different levels of its staff. To begin with, nursing staff would rotate through various service units within Hospital XYZ, and not only acquire additional clinical skills, but also familiarize themselves with the different systems (e.g. electronic, paper-based, processes, people, etc) and become enterprise knowledgeable employees. Such employees are critical for the functioning of Hospital XYZ, as they facilitate the flow of patients and information, and even more so, in the absence of clear standards and fragmented information systems. Furthermore, different service units exhibited an innate predisposition towards continuously improving their internal processes (e.g. track patient discharges and reasons for delays) as well as those interacting with other service units (i.e. admitting ED patients to an inpatient service unit).

Hospital XYZ Organization EA View

Hospital XYZ's origin and early beginnings was previously described in section 7.1. Essentially, Hospital XYZ is a non-profit physician led medical center and teaching hospital with a longstanding culture of specialized teams. The hospital began as a for-profit physician group practice led by its founding surgeon which rapidly increased the size of the practice as he offered more specialized care. Since its inception, the CEO of Hospital XYZ has always been a surgeon. As part of its growth plans, the group practice decided to build its own hospital in the late 1970s in order to have more control over patients and over the financial flow. The group practice was allowed to build its hospital in its current location and to change its status to non-profit, provided that it added primary and emergency care services to its service offering. Both the state and the

surrounding community made that an ultimatum requirement for Hospital XYZ to build its hospital. Senior leadership complied but still today defines its character as specialized care primarily engaged in tertiary diagnostics, rather than being a community hospital. In essence, unlike other hospitals which acquired or contracted physician group practices, Hospital XYZ began as a group practice and built its own hospital. Nonetheless, when the capitation payment model was in vogue, Hospital XYZ did increase its primary care physician practices throughout the region, and geared operations towards covering a greater number of patients, whilst managing their care and keeping them healthy. Over time, capitation fell out of favor with the public, and Hospital XYZ didn't appreciate insurance company arrangements either, and thus returned to a fee-for-service model. Notably, despite the significant differences in the payment models, Hospital XYZ's baseline objective and indeed culture, were the same, namely to continue to grow financially and its reputation of excellence of providing high-tech multispecialty care. Hospital XYZ has clearly been successful in achieving these goals as evidenced in its strong financial numbers and the multiple awards given by third party organizations.

Hospital XYZ's enterprise organizational climate is strongly aligned amongst clinical staff across various functional areas and at multiple levels of authority. It isn't uncommon to find clinical staff that has been with the organization for at least 15 years, and each and every one of them resonates with the mission of delivering the highest level of care in any patient encounter. However, a close examination of the interview data depicts strong differences of opinion, as to how Hospital XYZ is delivering on its overall mission. There are essentially three groups within the organization. On one side of the spectrum there are those who are close to Hospital XYZ's culture of providing high-tech procedures, and are thus receptive and aligned with senior leadership. It is clear that they realize that the ED is struggling with overcrowding but their priority is towards elective cases, and resources are geared towards accommodating the specialist clinics. On the other side of the spectrum there are those who feel that Hospital XYZ is failing to deliver the adequate level of care to the surrounding community, which requires not only high-tech procedures, but also primary and emergency care services, as per Hospital XYZ's initial mandate, or that which is expected of any hospital. Furthermore, physician leadership in the ED felt

that it had been neglected not only in terms of investment but also with regards to the ED's contribution to sustaining Hospital XYZ's procedure oriented growth strategy. In the middle of the spectrum were those who didn't particularly side with senior leadership, or the physician leadership of a particular service, and were sensitive to both elective and emergency patients. Finally, within senior leadership itself, the non-clinical leaders (i.e. CFO and Chief of Strategy) felt that other leaders (i.e. CEO and COO) sided with physicians in the organization, and didn't push through with previously agreed measures that would change and improve the system.

At a service unit level, organizational climates were consistent insofar that patient throughput was high and clinical staff felt stretched to accommodate patient demand. Furthermore, Hospital XYZ's staff was employed under a salaried model. Notably, not everyone received the same salary and there was some indication that higher revenue generating subspecialties were rewarded accordingly with higher salaries. Finally, inpatient service units were also consistent in describing their general frustration towards housekeeping and the inherent process complexity entailed by the fragmented information systems.

When considering the various service units there were distinctive differences characterizing their subculture and organizational climate. On one end of the spectrum, there was the ED. As noted, the ED physician leadership felt neglected by senior leadership, which contributed to frustration and was evidence of their low importance in the enterprise power environment. Such frustration was also evident among other clinical workers, who were quitting their job at Hospital XYZ, as they didn't feel they were providing the specialized care they were trained for, and also felt frustrated with the complexity of the underlying system (e.g. IT systems, processes, etc). Interestingly, the ED provided for a safe environment where clinical staff of all levels felt that they could engage with others to ask for help or even to question decisions. Moreover, nurses and physicians worked very closely and valued each other's contribution to the delivery of care.

On the other side of the spectrum was cardiology and the way it operated the inpatient service unit 5W. Being the highest revenue generator for Hospital XYZ enabled cardiology's leadership to focus on elective cases, and to regard the ED as their buffer, or a means to support their operations (e.g. order additional tests; delay admitting patients; etc). Notably, the communication amongst senior physicians and nurses in 5W was poor, and nurses had not only been denied regular debriefings with physicians, but were also very careful in their interactions with physicians. All in all, 5W concentrating the majority of cardiology patients, was a reflection of cardiology's predisposition towards clinics, and the cathlab, while remaining at an arm's length from other service units, and the ED in particular.

In the middle of the spectrum, in terms of clinical specialties, were neurosurgery and orthopedics, which were also reputation flagships for Hospital XYZ and generated a combined 14.31% of total patient revenues. As with the ED, nurses and physicians worked closely together and valued each other's contribution to the delivery of care. Senior physician leadership was protective of its resources (i.e. OR orthopedics database inaccessible to outsiders) but very open to streamlining processes with the ED, despite it only representing similar patient volume as the ED supplied cardiology with. Notably, clinical staff in inpatient service unit 7C was proactive towards continuous improvement, and regularly sought process improvements in their operations, while being mindful to other services in Hospital XYZ. However, such proactive posture also reflected a frustration towards the underlying support that clinical and administrative support staff was able to provide.

Interestingly, both clinical and administrative support staff expressed frustrations of their own towards Hospital XYZ's senior leadership, as well as the medical and surgical specialties and inpatient service units. In terms of clinical support services, these primarily experienced frustration towards the localized optimization behaviors that were common practice and were adversely affecting their own operations (e.g. a lab specimen without any orders; drugs being stolen from other drug dispensing units; etc). However, they were also sensitive to the issues that were driving such behaviors (e.g. fragmented

and arcane information systems). Some of the clinical support staff also sided with the ED in their appreciation that Hospital XYZ wasn't meeting the expectations of the surrounding community in terms of primary and emergency care, but they also conceded that healthcare is in general a fierce market environment, and thus senior leadership's focus on high revenue generating procedures.

In terms of administrative support services, these were consistently struggling with the localized optimization behaviors that were common practice and adversely affected their ability to maximize Hospital XYZ's throughput (e.g. nurses from different service units couldn't cover for each other because they had different standards for the same type of processes). Similarly, they were frustrated in their inability to access existing information held by specific ORs. Different stakeholders felt differently empowered and supported by Hospital XYZ's senior leadership. Notably, the Quality and Safety department expressed a concern towards senior leadership's lack of prioritization, and 90% of process improvement initiatives following external requirements without any clear direct relationship to a core internal strategy. Conversely, administrative support for inpatient services (e.g. perioperative services), were aligned with senior leadership, as they were responsible for managing medical and surgical procedure related operations.

Finally, with regards to the modes of service unit coordination, these followed closely the characterization of the service unit's organizational climate and subculture. In general, flagship specialties had higher importance in the enterprise's power environment, and exercised a greater degree of control over their service unit, as well as influence beyond the boundary of their service unit. Furthermore, the use of Charge Nurses responsible for facilitating flow within and across designated inpatient service units, was common practice across Hospital XYZ (i.e. boundary spanners). However, different service units adopted more sophisticated practices in terms of their boundary spanning activities (e.g. proactively visiting another inpatient service unit, or the ED, or the hospital patient bed board). Similarly, adhoc cross departmental and service unit management boards were invariably implemented and sustained.

Hospital XYZ Process EA View

The delivery of specialized care often entails a series of complex processes which ideally follow pre-established evidenced-based-practices so as to deliver the highest quality of care. However, determining what constitutes evidenced-based-medicine and assessing whether or not these are being followed, more often than not requires both clinical training and expert knowledge in a given subspecialty, which were beyond the skill set of our research team and would have represented a much too granular lens in the context of this enterprise level research. Instead, our analysis from a Process EA View primarily concerned enterprise level processes, and from that lens also included evidenced-based-medicine practices as appropriate (e.g. patient handoff between service units).

In general we found that various service units had adopted their own standardized practices and workarounds, as a result of their local optimization behavior. At times, said behavior resulted in visible improvements (e.g. patient flow) within and across service units. However, it was also often the case where said behavior hindered other service units upstream and downstream. Examples included patient beds being requested ahead of time, or definite ED admissions being delayed purposefully to get additional tests, etc. As a result, undesirable *fire fighting* had become common practice in order to streamline a series of broken processes, and resolve issues arising from scarce resources being requested by competing specialties.

A direct result of these practices is a diminished ability for the enterprise to measure its performance. The absence of stable and standard processes compromised enterprise process improvement and planning initiatives. Notably, the previously examined fragmented information systems, also negatively contributed to a lesser performance measurement capability. However, there were other issues compromising Hospital XYZ's Process EA View. Specifically, administrative support services consistently focused their attention in redesigning processes within each service unit, in an attempt to maximize local efficiency, and did so at the potential expense of adjacent service units in the value stream. In essence, Hospital XYZ was following the industry standard of lean implementations, which seldom considered improvement beyond the boundary of a

single service unit, and never specifically considered the enterprise as a whole (i.e. beyond the process architecture). One notable example was the contracting of lean experts to increase the throughput between the ED and radiology for those patients requiring contrast imaging, following a new performance incentive established by Medicare for that process. The improvement initiative not only cost a significant amount of resources (i.e. consultants and organizational labor) but also failed to consider that less than 3% of the ED's patients required that particular process. Evidently, at least in this instance, improvement efforts involved two service units, but the same improvement resources could have been better applied elsewhere, and would have attained a higher rate of organizational acceptance (i.e. generally those involved in improvement efforts felt that their cost didn't translate into worthwhile benefits).

Finally, Hospital XYZ could partially be considered to be measuring hospital enterprise performance insofar as it captures the multiple performance dimensions identified in Chapter 2. However, although the performance content is holistic, processing of said content and subsequent decision making, is very fragmented. For example, one department concerns itself with operational metrics, while another department focuses on financial metrics, and yet another one on clinical metrics, and none of them cross-reference their data in order to holistically examine enterprise performance. Similarly, different service units had access to different performance dimensions concerning their individual operations, and were even denied access to additional existing information. Finally, it is important to note that a more thorough examination of EA View interactions will further explain why these practices were taking place. Ultimately, we determined that holistic content was available, but it was being processed in a fragmented way, and ultimately preventing hospital enterprise performance measurement.

Hospital XYZ Service EA View

Hospital XYZ has several mechanisms in place to help manage its extended enterprise, although these are adopted at different levels of the organization. At an enterprise level, Hospital XYZ is building a specialized referral network through its medical training programs, and its close partnerships with surrounding community hospitals which refer

them the most complex cases. Similarly, Hospital XYZ has centralized procurement of its supplies (e.g. drugs, surgical kits, etc) through one of the largest healthcare distributors in the US. However, at a service unit level there are different practices in place with regards to the management of the extended enterprise. As previously noted, some service units are proactive in their continuous improvement and to that effect have implemented processes that help manage the relationship with patients and their respective families, as well as with other providers for follow-on care (e.g. rehab facilities). Similarly, said service units adopt demand leveling practices which manage the elective case flow from clinics, with regards to the expected discharge flow within the hospital. Conversely, other service units don't apply any of these practices while attempting to accommodate as much elective volume as possible.

In terms of service architecture management, once again Hospital XYZ exhibits variable behavior amongst different service units. Partly it is a refection of the just mentioned leveling flow practices in place. Similarly, the quality of the relationship amongst clinical staff, impacts the information availability and timeliness, which are essential to manage patient flow. Some inpatient service units are better able to discharge their patients and manage their interactions with the ED, as a direct result of their nurse-physician communication practices (i.e. 7C). The variability amongst service units necessarily impacts the service sustainability, both in terms of the quality of the patient's experience and that of the clinical staff caring for them. For instance, patients who find themselves in a stable condition waiting for a considerable amount of time in the ED, become aggravated and even hostile towards the clinical staff. Similarly, clinical staff find themselves stretched, and in some cases wondering whether they will be able to resolve patient flow issues, while in others finding themselves dissatisfied with caring for patients that require a different type of skill. Additionally, and most evident amongst ED physicians, clinical staff may feel unable to adequately care for their patients, and have considerable animosity towards others within Hospital XYZ. In essence, different patient populations were having a better experience, as were the clinical staff caring for them. Beyond clinical staff, a divide seems to exist between clinical and administrative support

services with the various service units, as these at times don't share vital information that could help in the management of the service architecture.

All in all, the prevailing practices in terms of the management of the extended enterprise and the hospital's service architecture reflect a mostly fragmented service architecture awareness/appreciation. Specifically, a service unit which solely concerns itself with its own operations (as evidenced by local optimization behaviors, or policies focused only on elective patients), demonstrates a lack of appreciation for the underlying service architecture. Conversely, a service unit which is sensitive to the potential repercussions from changing its local processes, and engages with other service units to work towards streamlining flow, is evidently aware and appreciative of the underlying service architecture. Notably, at times the adverse impacts of service unit behaviors are unknown to those sustaining said behaviors, and thus demonstrate more of a lack of awareness, rather than appreciation. However, in the case of Hospital XYZ's senior leadership in particular, there is both a lack of awareness and appreciation, which together further hinder the service architecture. One example was senior leadership's surprise upon realizing that its proposed self check-in kiosks envisioned for the ED, would have minimal effect on the overall patient flow, as compared to the time spent in other key processes. Ultimately, both a lack of awareness and appreciation were evident in the scope of enterprise transformation plans (e.g. strategic planning document had no mentioning of the ED, and was primarily focused on building new ORs, without adding additional bed capacity).

Finally, despite the architectural dysfunctionalities highlighted this far, Hospital XYZ was undoubtedly successful on its integrated multispecialty care delivery strategy, as compared to the traditional fragmented provider *cottage industry* where patients have to travel and wait a significant time between appointments with different physicians and collecting different ancillary tests. As previously noted, one of Hospital XYZ's core capabilities is the provision of team based care stemming from its multiple medical and surgical specialties, which allow it to provide high quality care to patients suffering from multiple illnesses. However, our analysis uncovered the importance of also evaluating

said integrated practices in terms of the service continuity, namely the care provided within and across patient visits, and not only during a single visit. Such a construct is key in ultimately assessing whether or not a hospital enterprise is adopting lean enterprise principles. In the case of Hospital XYZ, two particular phenomena are evidence that mindful management towards service continuity was absent. First, senior leadership measured its service architecture in terms of system use (i.e. patient encounters) rather than patient centered care, as evidenced by its performance measurement reports (i.e. volume based), and its underlying information systems (i.e. indexed by patient encounter number). Second, and more concerning, important information pertaining to multiple patient visits could potentially go unnoticed to the multiple physicians caring for a particular patient suffering from multiple illnesses. In essence, potentially adverse effects from a patient's system failure weren't being communicated with those responsible for his or her other internal systems. Finally, it is important to note that a more thorough examination of EA View interactions will further explain why these practices were taking place.

Hospital XYZ Strategy EA View

Hospital XYZ's strategic goals, vision, and business model have been previously described in sections 7.1 and 7.5. Essentially, the key elements of Hospital XYZ's strategy were said to be the integrated multispecialty care delivery, the provision of highly sophisticated care, medical teaching (i.e. medical students, residents, and fellows), and finally, its community hospital alliances. All four strategic elements are meant to support the overall goal of continuously growing financially strong, so as to also continuously increase Hospital XYZ's reputation of excellence in providing high-tech multispecialty care. Hospital XYZ has clearly been successful in achieving these goals as evidenced in its strong financial numbers and the multiple awards given by third party organizations. However, an assessment based on lean enterprise principles, whilst leveraging our privileged access to the organization, reveals significant room for improvement in terms of Hospital XYZ's Strategy EA View.

To begin with, it is clear from both the quantitative archival analysis and qualitative data analysis that the ED is contributing towards Hospital XYZ's core growth strategy both financially and in supporting inpatient operations. However, in several of our initial interactions with senior leadership, their assessment was quite the opposite. Moreover, senior leadership (and admittedly some inpatient specialties) didn't readily recognize the ED's contribution, and had no intention in significantly investing in their capabilities.

In terms of enterprise strategy alignment it was evident that a key conflict existed between a growth strategy centered on high revenue generating subspecialties, and a state and community mandate to provide primary and emergency care. Close examination of the Strategic and Operational Plans shared by Hospital XYZ's senior leadership, show no less than 16 strategic objectives (i.e. advance evidenced based medicine; care process management redesign; functional unit strategic growth planning; philanthropy; electronic medical record development; medical education strategy; medical research strategy; customer relationship management; physician recruitment; nurse recruitment; operations improvement; people strategies; primary care re-engineering; retail and cash services; supply chain management; and safety). By inspection, the ED is neither included in any of these 16 strategic objectives, nor in any part of the strategic documents. Furthermore, the extensive list of objectives is additional evidence of the lack of prioritization mentioned by the Quality and Safety department. It can, therefore, be concluded that Hospital XYZ's strategic portfolio exhibited both conflicting strategies as well as a diluted attention span.

Finally, when considering the enterprise transformation projects underway, and as previously mentioned, it was clear that senior leadership was favoring investing in specific segments of its service architecture (i.e. ORs) whilst neglecting other upstream and downstream service units. The criterion for said investments was determined on an independent functional unit basis and in terms of the revenue generating potential. Clearly, this approach didn't follow several of the lean enterprise principles outlined in Chapter 2. For instance, only investing in the ORs failed to consider the interdependencies with other service units (i.e. 4th principle), and electing to only focus

on higher revenue generating services (i.e. non-holistic as per 1st principle), alienated several stakeholders within Hospital XYZ and also hindered its relationship with the surrounding community (i.e. 2nd principle).

Ultimately, it is important to note that Hospital XYZ's behaviors examined from a Strategy EA View, strongly reflect the effect of EA View interactions. In its simplest form, senior leaders are in themselves part of the Organization EA View, and upon executing their leadership processes (Process EA View), they define and refine the Strategy EA View. Several of these interactions, as well as others, will now be described in detail in the next section.

7.3.3.2 Hospital XYZ EA View Interaction Analysis

In Chapter 3 we clarified that the meaning of holistic pertains not only to an enlarged number of views used a framework but also to an "*understanding of the interactions of the views [which] becomes of increased importance*" (Rhodes and Nightingale 2008). As noted before, this research adopted an enterprise diagnostic mindset and held no pre-conceived notion of organizational element interactions including strength and direction. Such an approach reflects the described nascent phase of EA theoretical development and allowed for the iterative improvement of our understanding and characterization of each of the EA views both individually and holistically while comparing and contrasting empirical results within and across cases.

Notably, hundreds of EA View interaction instances were documented over the course of our analysis, as evident in the detailed descriptions for each of Hospital XYZ's stakeholder groups. What follows is a description of the dominant EA View interactions that emerged from the exploratory case of Hospital XYZ, which further explain the enterprise's performance and the extent of lean enterprise principles being adopted.

A series of regulatory requirements on multiple EA Views

External | Information | Knowledge | Organization | Process | Service

The influence of *external stakeholder value requirements* and those of regulatory agencies in particular, directly affects multiple EA Views. The following are the most

prominent for a hospital enterprise. *Hospital enterprise information systems* need to be in place in order to capture patient treatment information, which is later used for billing purposes, and while ensuring patient privacy (i.e. HIPAA[145]). Expert panels determine evidenced-based-medicine practices embodied in *codified* clinical pathways which should be followed by hospital providers, and in several cases require public reporting if the hospital is to receive payment for services rendered. *Modes of service unit coordination* need to oversee the continuity of patient care when transferring a patient between service units. Set patient-to-nurse ratio *standards* need to be adhered to and these vary in terms of patient severity. *Service continuity* needs to be assured whenever pertinent information regarding a patient becomes known to a provider who should then act appropriately and contact the patient if need be (e.g. ED tracking down patients who left-without-being-seen by a physician and whose test results signaled a complication requiring immediate attention).

Strategy enacting upon both the payment model and the enterprise's core culture

External **Organization** **Service** **Strategy**

The definition of Hospital XYZ's *enterprise strategy elements* reflects the influence of its *enterprise history and culture* as well as that of *external stakeholder value requirements*. Hospital XYZ's decision to grow high revenue generating service lines, followed the enterprise's procedure oriented culture, and responded to the incentives posed by the fee-for-service payment model. Notably, when the payment model was geared towards capitation, Hospital XYZ changed its *service architecture* by increasing the number of primary care provider locations, and implementing processes to manage patient care and keep them healthy. Upon reversing back to the fee-for-service model, Hospital XYZ began dismantling its primary care network, and started building its reputation around the higher revenue generating services.

[145] Health Insurance Portability and Accountability Act.

A non-appreciated ED

External Organization Strategy

The ED was contributing financially to Hospital XYZ's core growth strategy as well as supporting its operations. However, senior leadership as well as some inpatient specialties weren't *aware or appreciate* the ED's contribution. A series of internal and external factors may be contributing to this phenomenon. First, since its inception, Hospital XYZ had to provide primary and emergency care services as mandated by *external stakeholders* (i.e. the state, following pressure from the surrounding community). The provision of emergency care was seen as a necessary nuisance towards reaching the desired goal (i.e. building Hospital XYZ). In essence, emergency care wasn't considered part of Hospital XYZ's core *culture*. Second, it is common practice for hospitals not to be reimbursed for services rendered in the ED on patients that were later admitted. All of the patient's stay is normally only billable as a single code meant to represent all of the services rendered throughout the patient's stay. As a result, the ED's financial contribution is further removed from senior leadership's analysis.

A narrow enterprise transformation scope compromising service sustainability and organizational climate

External Organization Service Strategy

Investment decisions were based on each service unit's 'financial credential', or more simply, its expected return-on-investment as determined by the services which payers were willing to pay higher prices. Since its inception the ED only underwent minor localized improvements and wasn't targeted with significant capital investment. Conversely, a series of ORs were newly built in order to accommodate the increased volume of elective cases stemming from a growing specialist referral network, and extensive marketing campaigns. Notably, the *enterprise transformation scope* was narrow as it focused on building ORs, but didn't add capability in terms of inpatient beds, recovery room beds, ED beds, or additional labor at any of these service units. A series of internal issues resulted from this. First, it worsened the *organizational climate* at both an enterprise level and service unit level, as the ED felt neglected and competing for scarce resources with inpatient specialties. Second, it compromised *service sustainability* both in

terms of patient experience and that of enterprise employees. Patients found themselves waiting for a considerable amount of time in the ED, and in particular those of acuity level 3, normally associated with traditional emergency care needs of a hospital's surrounding community. Employees were stretched thin trying to accommodate increased patient volume with the same amount of resources, while at the same time feeling a deterioration of their interaction with no longer cooperative patients, and ultimately, feeling a disconnect with their role as they were treating patients that required different care skills. Moreover, the compromised service sustainability further exacerbated a deteriorated organizational climate.

A diluted and narrow enterprise process improvement and planning scope

External **Organization** **Process** **Service** **Strategy**

Enterprise process improvement and planning lacks prioritization from senior leadership who requires Quality and Safety to implement and improve several processes demanded by different *external stakeholders*. A series of internal issues resulted from this. First, Quality and Safety, as well as process improvement engineers, were critical of senior leadership's approach, and although they didn't do so in an outwardly fashion, it deteriorated the *enterprise organizational climate*. Second, Quality and Safety employees felt stretched in pursuing multiple disparate initiatives which were narrowly focused on specific processes that mostly resided within a single service unit. Ultimately, improvements neglected service *architecture awareness* and merely followed what was required by *regulatory* and large *payer stakeholders*, rather than an *enterprise strategy*.

Fragmented and costly state-of-the-art information systems compromise process measurement capability and service architecture management

Information **Organization** **Process** **Service**

Hospital XYZ lacked overall *information systems integration* which was the result of several factors and in turn generated multiple enterprise behaviors. To begin with each service unit exercised its influence to acquire state-of-the-art software without an initial reference to the overarching IT architecture, which invariably compromised the degree of *information systems integration*. In turn, vendors of existing software solutions in place

demanded expensive fees in order to build additional information systems capability. As such, this further reinforced *local process optimization behavior* whereby different service units would continue to buy isolated software solutions, or would build their own homegrown solutions, which were equally disconnected from the overall IT architecture. Five related issues arose from said system fragmentation. First, there was a reduced *process measurement capability* as data couldn't be easily aggregated across the different systems, and some service units refused to share their homegrown data. Secondly, *service architecture awareness* was compromised as there wasn't a means of conducting end-to-end quantitative workflow analysis (e.g. determining how much time is spent in each of the ED's key processes, as well as in transferring patients to different inpatient service units). Third, this represented a missed opportunity to support *enterprise process improvement and planning* beyond the traditionally narrow lean implementations. Fourth, fragmented systems require additional human intervention, and hence add to the *process complexity* carried out by clinical staff members (e.g. lab technicians need to track down patients by calling multiple inpatient service units; nurses need to insert redundant information into multiple systems; etc). Finally, *service architecture management* as a whole may be compromised as information isn't available in as timely fashion as possible, and patients are consistently required to provide information which they have given before, thereby adversely impacting their patient experience.

External factors may induce service unit behaviors which lack a service architecture appreciation

External Organization Process Service

Hospital XYZ's external *context* and *stakeholder value requirements* induce different behaviors on different service units which ultimately trigger other effects across the enterprise. For instance, the ED faced with increased patient demand and struggling with *service sustainability* as evidenced in its overcrowding with patient's boarding in the ED, resorts to *local process optimization behavior* by attempting to secure inpatient beds ahead of time, or transferring patients to GIM before conducting baseline tests. Such practices have the potential of compromising *service architecture management* elsewhere in the enterprise, as beds are potentially being held unnecessarily, and clinical staff are

having to oversee patients who aren't yet in a stable enough condition. Similarly, the focus of some inpatient specialties on elective cases, prevents the ED from admitting its patients, and hence exacerbates the ED's optimization behavior and adversely affects its *organizational climate*. Several other related examples emerged in analyzing Hospital XYZ (e.g. ordering lab tests with blank orders to prompt a lab technician call back; nurses holding on to beds and delaying be availability in the system to avoid receiving another patient; admitted patients held in the ED to conduct tests which could be done as inpatients; drugs being stolen from drug dispensing machines to ease a nurse's own care process; inpatient specialties capping their admissions even though inpatient beds and staff are available, etc). Ultimately, whenever a service unit carries out *local optimization behaviors* without concern for the potential impact upstream and downstream to other service units, it is effectively lacking (or potentially ignoring) a *service architecture awareness*.

Local optimization behaviors may compromise organizational learning capability and reinforce enterprise fragmentation

Knowledge **Organization** **Process** **Service**

As noted, different service units exhibited different *local process optimization behaviors*. Said behaviors at times resulted in local standards which reduced *flexibility* and increased *complexity* as it prevented nurses from being readily shared amongst inpatient service units, and also increased the process variability amongst interacting units (e.g. there were unnecessarily multiple ways of servicing different units for the same simple task). Additionally, local standards weren't *codified* into protocols or training manuals and thus resided as *tacit knowledge* and required human resources to enable their *transfer* to other employees. In turn, this further reduced flexibility as service units became dependant on specific "go to" employees (e.g. ED bed "air traffic controller"). Ultimately, the existence of localized undocumented process optimization behaviors, hindered Hospital XYZ's *organizational learning capability*, and reinforced its fragmentation.

Different internal architectural configurations exhibit different levels of service architecture awareness and make decisions that enable different levels of hospital performance

Information Knowledge Organization Process Service

Hospital XYZ had multiple internal architectural configurations embodied in its service units, and which generated different levels of hospital enterprise performance. Neurosurgery and orthopedics (centralized in inpatient service unit 7C) questioned Hospital XYZ's *information systems sustainability*, and initially struggled with maintaining *service sustainability* (i.e. unsatisfied patients). However, their local physician leadership held sufficient *service unit enterprise importance* and were able to institute *local process optimization behaviors* targeted at both 7C and the ED. Examples include the creation of paper-based surveys to track 7C's discharge performance as well as its ED admissions performance. Furthermore, physician leadership fostered a safe environment for both junior medical staff and nurses, thereby enhancing their *service unit organizational climate* as well as improving communication about patient treatment and patient flow. Similarly, charge nurses were critical *boundary spanners* as they proactively engaged with both the ED and hospital's patient bed board to discuss patient flow. Notably, such initiatives allowed 7C to improve its *service architecture management* (e.g. level elective cases with expected discharge; discharge patients every morning by 10am). Ultimately, clinical staff in 7C had an *organizational learning capability* which allowed them to compensate for compromised hospital information systems, and successfully address service sustainability. All in all, we established that unlike Hospital XYZ's inpatient service unit 5W (i.e. worse performer), **the inpatient service unit 7C had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream**.

7.8 Chapter 7 Summary

In this chapter we presented the first of our two in-depth exploratory studies of leading multispecialty hospitals, as we empirically and theoretically enriched MIT's Nightingale-

Rhodes Enterprise Architecture Framework (NREAF), and explored whether an enriched understanding of hospital enterprise architecture can improve hospital performance

We followed our hybrid research design which consisted of qualitative and quantitative data collected from multiple levels of the organization, and assessed multiple dimensions of performance, using both subjective and objective data. A total of 34 interviews were conducted, of which 29 were recorded, transcribed, and subsequently coded. Several walkthroughs, hosted by various clinical staff members, were made throughout different areas of Hospital XYZ, as well as a series of non-participatory observations made at different days of the week and at different times of day. Finally, archival record analysis examined two separate data samples. The first one consisted of a month's worth of data with approximately 3000 patients, of which approximately 700 were admitted as inpatients to Hospital XYZ, and for all of which detailed patient throughput was analyzed. The second sample consisted of a year's worth of data with approximately 24000 inpatient discharges, which allowed assessing the contribution of each service unit, and their respective patient source, to Hospital XYZ's performance.

We determined that Hospital XYZ's ED was indeed overcrowding but largely because of its interaction with inpatient specialties and their respective inpatient service units, rather than it being a matter of simply increasing productivity in the ED, as initially proposed by senior leadership. Furthermore, when measuring Hospital XYZ end-to-end we determined that its ED was contributing directly to the core growth strategy of high revenue generating procedures, as well as supporting hospital operations in general. However, the ED was struggling to care for acuity level 3 patients, who were consistent with the primary and emergency care needs of the surrounding community.

A close examination of the coded qualitative evidence, together with the quantitative archival record analysis, and the insights generated from chapters 2 and 3, gave rise to a total of 24 main categories and 53 subcategories in the enrichment of MIT'S NREAF. Leveraging our enriched version of the NREAF, the data was reanalyzed, comparing and contrasting findings within and across cases, and ultimately identifying dominant EA

View interactions, which further characterized Hospital XYZ's EA in relation to its performance, and the extent to which lean enterprise principles were being adopted.

We identified that a hospital enterprise may consist of multiple internal architectural configurations, and that these in turn generate different levels of hospital enterprise performance, where performance is measured as a multidimensional construct, both in terms of dimensions and stakeholders. Specifically, a specialty and/or hospital generating high revenue by focusing on elective cases, while pressuring or indeed neglecting emergency cases, and in doing so affecting stakeholders within and across the hospital enterprise, isn't in line with the practices of a lean enterprise. However, the reverse behavior whereby the needs of elective and emergency cases, as well as those of the specialties servicing them, are addressed in a transparent and balanced manner, are in line with the practices of a lean enterprise, and more capable of delivering higher hospital enterprise performance. Specifically, we established that unlike Hospital XYZ's inpatient service unit 5W (i.e. worse performer), **the inpatient service unit 7C had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream**. Finally, it seems that an architectural deficiency in one or more EA Views, may be compensated by the particular configuration of the remaining EA Views.

We clarified that hospital enterprise performance measurement should not only be assessed in terms of its content adhering to lean enterprise principles, but also whether the process analyzing said content also follows lean enterprise principles. Specifically, Hospital XYZ could partially be considered to be measuring hospital enterprise performance insofar as it captures the multiple performance dimensions identified in Chapter 2. However, although the performance content is holistic, processing of said content and subsequent decision making, is very fragmented. For example, one department concerns itself with operational metrics, while another department focuses on financial metrics, and yet another one on clinical metrics, and none of them cross-reference their data in order to holistically examine enterprise performance. Similarly,

different service units had access to different performance dimensions concerning their individual operations, and were even denied access to additional existing information. Ultimately we argued that a lean enterprise hospital would measure its performance in the context of all of its patient population, including elective and emergency cases, and all of its service units.

Finally, the healthcare literature regards integrated multispecialty providers as being better able to offer efficient higher quality care, as compared to what is traditionally described as the US's provider *cottage industry*. Hospital XYZ has clearly been successful as evidenced by its strong financial numbers and the multiple awards given by third party organizations. However, our privileged access to the organization, revealed fragmentation at several levels, and significant room for improvement.

In the next chapter we present the second of our two in-depth exploratory studies of leading multispecialty hospitals, as we continued to empirically and theoretically enrich MIT'S NREAF, and sought to test whether replication occurred with regards to our Hospital XYZ case findings described above.

8. UK Hospital In-Depth Study

What follows is the second of the two in-depth exploratory studies of leading multi-specialty hospitals. Hospital ABC[146] is located in the UK, and as with the previous chapter's in-depth case, it is ranked at the top 1% acute hospital in its country, and also grappling with a nationwide problem in 2008. Specifically, the NHS was beginning to apply financial pressure for hospitals to shorten elective surgery operating waiting lists. However, the intent of this chapter is not to compare Hospital ABC to Hospital XYZ but rather to continue to explore and further our understanding of the inherent complexity of high performing hospitals, to demonstrate the benefits of a systems thinking research approach, and determine to what extent literal replication[147] across both cases is established.

This chapter starts out by introducing Hospital ABC and presenting its history followed by a description of senior leadership's initial problem statement, and our necessary research design refinements. The subsequent three subsections describe in detail different areas of the hospital both individually and in relation to each other, namely the Main Operating Rooms, Administrative Support Services (e.g. process improvement engineers, performance and planning managers), and Specific Operating Rooms (i.e. Cardiac and Neurosurgery). Each subsection analyzes qualitative and/or quantitative evidence as these became available from building a trust based relationship with the organization and identifying additional data sources. In essence, inquiry was informed and reflected both lean enterprise principles and our enriched version of the NREAF presented in the previous chapter. The latter part of this chapter provides an overview analysis of Hospital ABC's enterprise architecture, while discussing whether an enriched understanding of hospital enterprise architecture can improve hospital performance.

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[146] Hospital ABC is a pseudonym used to protect the identity of the enterprise in the case study. Much of the analysis in the in-depth case is sensitive, so measures were taken to protect ABC's identify and disguise any identifying data.

[147] As noted in section 5.4.2.1, literal replication occurs when the phenomena of interest is found under similar conditions across cases (Yin 1994).

8.1 Hospital ABC Enterprise and its History

Hospital ABC is a multispecialty acute care and teaching hospital in the United Kingdom (UK), not only serving an inner city population of over 700,000 people but also as a tertiary referral center to millions of people in the UK. Moreover, the hospital provides comprehensive local services to an economically challenged and ethnically diverse population, whilst at the same time builds clinical excellence in a portfolio of specialist services (e.g. liver transplants, neurosurgery, etc).

Hospital ABC began in the first half of the 1800s and early on pioneered several types of surgery, which earned it a reputation of being one of the most advanced surgical hospitals in Europe. The hospital's infrastructure itself was considered to be state-of-the-art at the time, with the implementation of adequate ventilation systems (e.g. reduce hospital infections), the ability to generate its own power, and notably one of the first internal phone systems in the UK. The hospital is incorporated into a one of the UK's best ranked universities and provides the setting for advanced medical training of students who have completed their pre-clinical training at the associated university. Hospital ABC's teaching status was only formally established with the creation of the National Health Service (NHS) in 1948.

The NHS[148] is the UK's publically funded health care system which provides free health care for all British citizens or legal residents (including foreign nationals). In the event of emergencies, care is provided for free regardless of citizenship or residence. Essentially, no percentage of the population is uninsured and no one has to co-pay for their primary care visits. With an annual budget of over £100 billion, the NHS caters to a population of 51 million people and employs more than 1.3 million people, totaling approximately 1 million full time equivalents, of which 100 thousand are doctors and 300 thousand are

[148] There are four NHS systems in the UK, and each of which is managed under a separate government (i.e. Wales, Scotland, Northern Ireland, and England). However, the English NHS is the only one officially referred to as the National Health Service.

nurses (National_Health_Service 2011). On average, qualified nurses earn an annual salary of £33,300 and consultants[149] earn £121,700 (National_Health_Service 2010).

Broadly speaking, the NHS is divided into two sections: primary care and secondary care. Primary care comprises the General Practitioner (GP)[150] as well as dentists, pharmacists, and optometrists, whereas secondary care concerns acute care facilities that provide elective and emergency care. Specifically, elective care means planned specialist medical care or surgery, usually following referral from a primary or community health professional such as a general practitioner. Each of the two sections is subdivided into trusts (e.g. Acute trust, Ambulance trust, Foundation trust, Primary Care trust, etc). An Acute Trust oversees one or more hospitals. Additionally, trusts may be further characterized as Foundation Trusts, which grants the institution a greater amount of operational and financial freedom than those that are merely classified as a Trust (e.g. managers have the flexibility to reinvest any surplus according to their internal plans, as opposed to having to return said surplus to the NHS). In total there are 167 Acute NHS Trusts (129 of which are Foundation Trusts) that oversee a total of 1,600 hospitals and specialist care centers in the UK.

Hospital ABC is a leading hospital in the NHS and the only hospital part of its Foundation Trust. In 2006 the hospital derived close to $750 million in operating revenues which translated into an operating income of $20 million, and at a time when most hospitals in the region were struggling to break even. With over 5500 staff and close to 900 patient beds, they have national and international recognition in particular for hosting the largest transplantation program in Europe for a particular surgical specialty, as well for their clinical excellence in cardiac, neurosciences, liver, etc. Furthermore, Hospital ABC also plays a significant role in clinical trials and both practices and contributes to research whilst adopting a multidisciplinary team model.

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[149] Consultant is the highest rank for a physician or surgeon in the NHS system regardless of sub specialty. Its equivalent in the US health care system would be "Attending Physician". For the remainder of this document we shall refer to them as physicians or surgeons as appropriate.
[150] The US equivalent is the Primary Care Physician (PCP).

8.2 Senior Leadership Initial Problem Statement

In 2008, the shortening of elective wait lists was still an increasing national imperative in the UK. Specifically, the NHS had instituted a policy entitled 18 Weeks which increased demands upon hospital operations, as it represented the maximum wait time from a patient referral to initiating treatment, and in the event of it not being met, the hospital wouldn't be paid for treating that patient, and would have to face an audit and additional potential penalties.

Hospital ABC, although a leading hospital in the NHS, and like the remainder of the country, found itself unable to meet the designated target (i.e. lengthy hospital waiting lists had always been the norm in the NHS system). As such, when senior leadership was approached in the context of this research they specifically requested that analysis focus inside their Main Theaters[151], and proposed the initial exploratory question of "How to increase productivity in the Operating Rooms?". Furthermore, they disclosed the hospital's performance scorecard which indicated that the ORs were only being used on average at 75%, and the inpatient unit bed utilization was also only 85%. Specifically, senior leadership thought that the ORs weren't being as productive as they could since, in their view, they weren't being held back by the inpatient service units (i.e. the bed utilization was "*only*" 85%). Hence senior leaders emphasized that the Main ORs were at fault. Finally, leadership also mentioned its plans to dismantle a prevailing individualistic culture amongst surgeons, which was contributing to system inefficiencies and were also an opportunity to improve patient outcomes.

> *"how we get individuals to work better together with the intent of improving patient outcomes. Health services use the word team quite a lot but doctors are very individualist in their orientation and culture. So we have a lot to do to produce genuine teams. [...]So we are currently dismantling our current individual approach."*
>
> Hospital ABC CEO

[151] Main Theaters are the equivalent of Main Operating Rooms in the US. The "Main" designation traditionally means that several surgical specialties share a given set of operating rooms (ORs). However, it is also common for multispecialty hospitals to have reserved ORs for specific specialties, as was the case with Hospital ABC's cardiac, neurosurgery, and liver specialties. For the remainder of the document Theaters will be referred to as Operating Rooms.

8.3 Research Design Refinements

Three research design refinements took place when studying Hospital ABC. Two of them were originally planned, whereas the other one emerged as a necessity having studied Hospital ABC's information technology architecture capability and determining that it was significantly inferior to that of Hospital XYZ.

While studying Hospital XYZ, data was collected over a series of onsite visits over an extended period of time. Conversely, at Hospital ABC data was collected over a one month period but benefited from the author being continuously onsite and integrated into the in-house lean department. Said department was a permanent structure that reported directly to the Director of Strategy and was created by the CEO to conduct lean transformation projects throughout the hospital. The author wore a badge with the designation of "Change Leader", had his own desk and telephone at the hospital, and was always introduced as a PhD student working on an independent research project.

Additionally, data collection at Hospital ABC also benefited from the research participation of a Harvard Medical School (HMS) student doing a surgery rotation at Hospital ABC during the same period. By design, only the CEO of Hospital ABC was aware that the author and the medical student were collaborating on the same research project, and hence additional valuable insights were obtained from Hospital ABC's physicians. Specifically, the HMS student collected observational and internal document data pertaining to her interactions with different surgeons while assisting them on different patient procedures performed in different ORs. Furthermore, the HMS student logged her data daily (i.e. within 24 hours from phenomena occurring) so as to preserve its contents and readily share them with the author, who then added it to his overall data collection and analysis.

Finally, in the previous chapter, a key insight while studying Hospital XYZ was the importance of having electronic systems in place that assist in the analysis of workflow across the hospital enterprise. Hence, electronic medical records are a necessary but insufficient capability, as these only concern clinical data to assist care practitioners, and

capture billing charges of any treatments rendered. Nonetheless, disparate information systems at Hospital XYZ were integrated in the context of this research, and also allowed for additional financial and workflow analysis. Notably, at Hospital ABC the underlying information technology infrastructure was limited and consequently constrained our ability to collect data and conduct quantitative data analysis. Specifically, all patient medical records were in paper format and all workflow heavily relied on paper and excel sheets residing in various departments. Pertinently, health care scholars have noted that "*the cost of collecting data depends on each hospital's information capabilities, which vary among hospitals and over time at any given institution*" (Mehrotra, Lee et al. 2003). However, the determining factor to seek an alternative data collection method was also the poor accuracy of the recorded data. For instance, the excel sheets mentioned, used different terminology and relied on the accuracy of whoever inserted and updated the data. Furthermore, an analysis of a random set of OR operating lists[152] yielded considerable inconsistencies in the data and made any retrospective data aggregation efforts meaningless. As a result, theoretical sampling at Hospital ABC took place on the basis of perceptual data (e.g. which ORs seem to be more efficient?) as well as pre-existing internal documents describing OR performance.

8.4 Main Operating Rooms Analysis

The data collection and analysis of the Main ORs took place over a one month onsite assignment and entailed two main phases. The first phase was mainly concerned with building an initial understanding of operations through a three hour walkthrough and as many as ten onsite visits on different days of the week and at different hours of the day, which were ultimately translated into a Value Stream Map (VSM). The second phase consisted observations and five individual interviews with different clinical staff, three of which were with physicians (i.e. two surgeons and one anesthesiologist), and two were with nurses managers (i.e. for the whole of Main ORs, and the recovery room specifically). All five interviewees allowed for audio recording. What follows is a description of each phase along with their respective key findings.

[152] An operating list is made available daily and comprises a varying number of surgical cases to be conducted by different surgeons, at different ORs, on different patients, and using different teams.

8.4.1 1st Main ORs Phase: Walkthroughs, observations, and VSM

Visits to the Main OR took place at different times of day and every week, so as to provide for a more representative picture of underlying operations. In following this approach it was immediately apparent that resource utilization varied with the time of day. Mornings were particularly hectic, in getting patients from the wards[153] to their respective OR, as were late afternoons when decisions were made on whether or not to cancel patient procedures. On the day of the first visit to the Main ORs the author was introduced to the Main OR Coordinator who then proceeded to give an overview of operations and the overall patient flow in the Main OR.

There are a total of 17 ORs at Hospital ABC: ten are located in the Main ORs, two are dedicated to Cardiac, three are dedicated to Neuro, one is for Liver, and one is for Obstetrics. The Main ORs cater to a predefined set of surgical specialties (e.g. orthopedics, urology, general surgery, etc) but may also accommodate other specialties that need the extra OR time (e.g. although neuro has its own ORs it also routinely uses space in the Main ORs). It is important to note that different ORs are accountable to, and managed by, different divisions within Hospital ABC.

Organizationally, Hospital ABC is divided in a series of divisions called "Care Groups". Each division houses one or more types of specialties, has its own division director, a clinical director, and a head of nursing. Additionally, each division has its own management structure with regards to procurement, recruitment, scheduling, coordination, and other functions. The Main ORs are part of the Surgery and Critical Care (SCC) division, and are shared by several surgical specialties. Notably, specific surgical specialties (i.e. cardiac, neuro, and liver) are part of their own divisions (e.g. Cardiac and Neuro; Liver and Renal; etc) and have dedicated ORs, which may or not be managed by their division directly. For instance, whereas the Liver and Renal division have their own OR and manage it independently, the Cardiac and Neuro division also have dedicated ORs, but these are managed by the Main OR Coordinator, who ultimately is accountable

[153] Wards are the UK equivalent of inpatient service units. For the remainder of this chapter wards will be referred to as inpatient service units.

to the division director of the SCC division. Furthermore, as previously noted, some specialties with dedicated ORs may share OR space provided by the Main ORs. These organizational distinctions are important in describing the overall context of the Main ORs, and will be elaborated in further detail in subsequent sections.

Figure 8-1 and Figure 8-2 provide for a simplified VSM of the Main OR. The initial intent was not to derive a very detailed process map with rigorous cycle times but rather to identify the key processes, information systems, shared resources, and points of interaction in terms of inflow and outflow to and from the Main OR. The following is a description of these key elements:

Patient Arrival Modes: Patients undergoing surgical procedures are either seeking elective care (i.e. scheduled ahead of time) or emergency care (i.e. emergency department (ED) trauma patient). Emergency patients are only moved from the emergency department once they have been stabilized, and are thus first transferred to an inpatient service unit before being brought to the Main OR for additional surgery. Only in very rare occasions are patients transferred directly from the ED to the Main OR. The bulk of patients are elective cases and there is a dedicated OR to cater for emergency patients; hence their flow isn't considered disruptive by the Main OR operations. Both elective and emergency patients are transferred using two different methods. In some cases the patients are accompanied by an inpatient service unit nurse who walks them to the Main OR area, while in others they require a Main OR porter to transport them in their bed. Porters are managed by the Main OR Coordinator and concern themselves with transferring patient beds between different service units (e.g. inpatient service unit to Main OR; recovery room to inpatient service unit; etc).

Main OR Hours of Operation: The Main OR is operational from 8 am to 5 pm, and on average each OR is meant to carry out three surgical procedures per day. However it is often the case that operations lists overrun and staff continue to work beyond 5 pm. Notably, a decision is made on a case-by-case basis as to whether to overrun the hours of operation or to cancel a case and reschedule it for a different day.

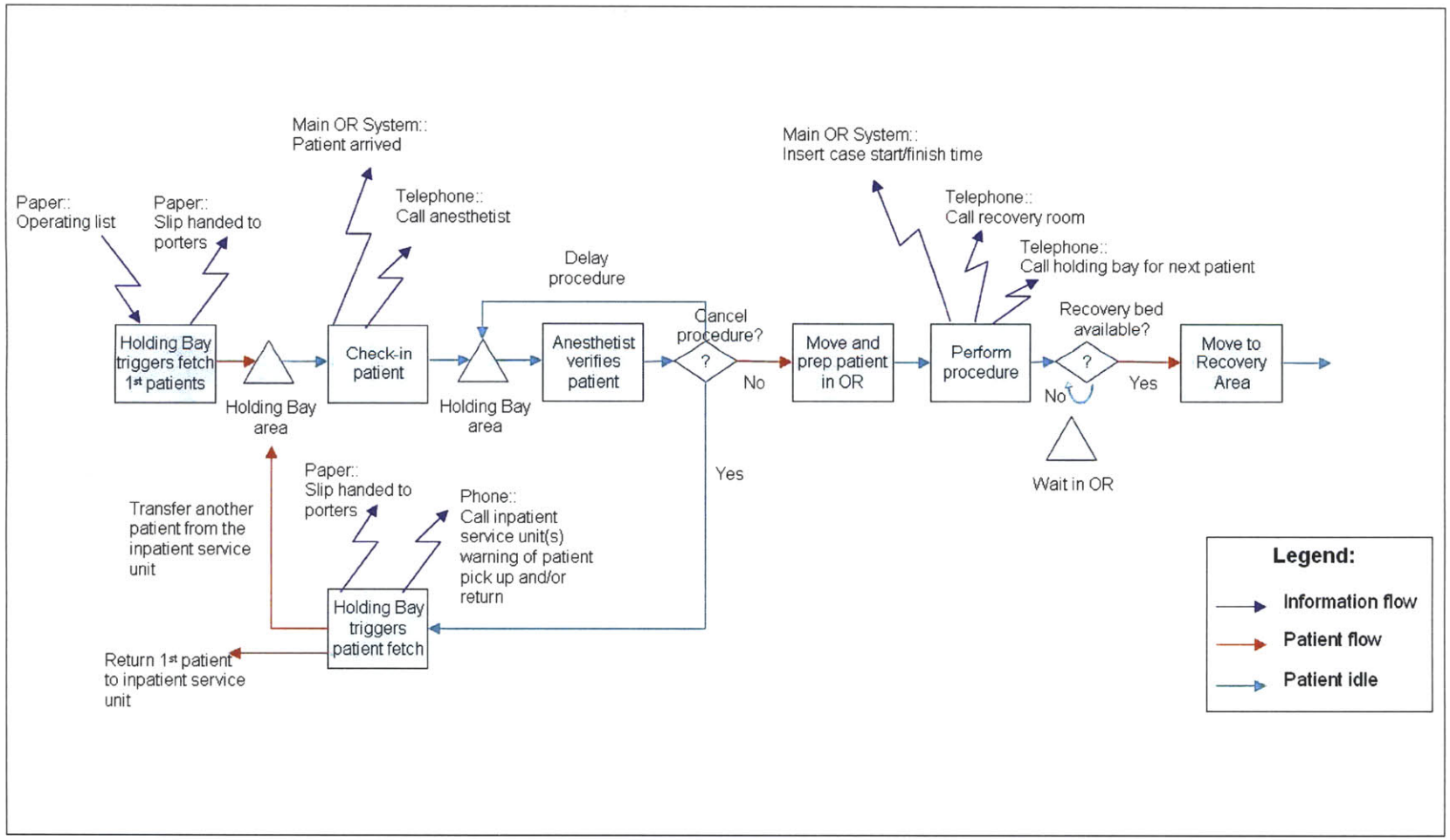

Figure 8-1: Hospital ABC Main ORs Value Stream Map (1 of 2)

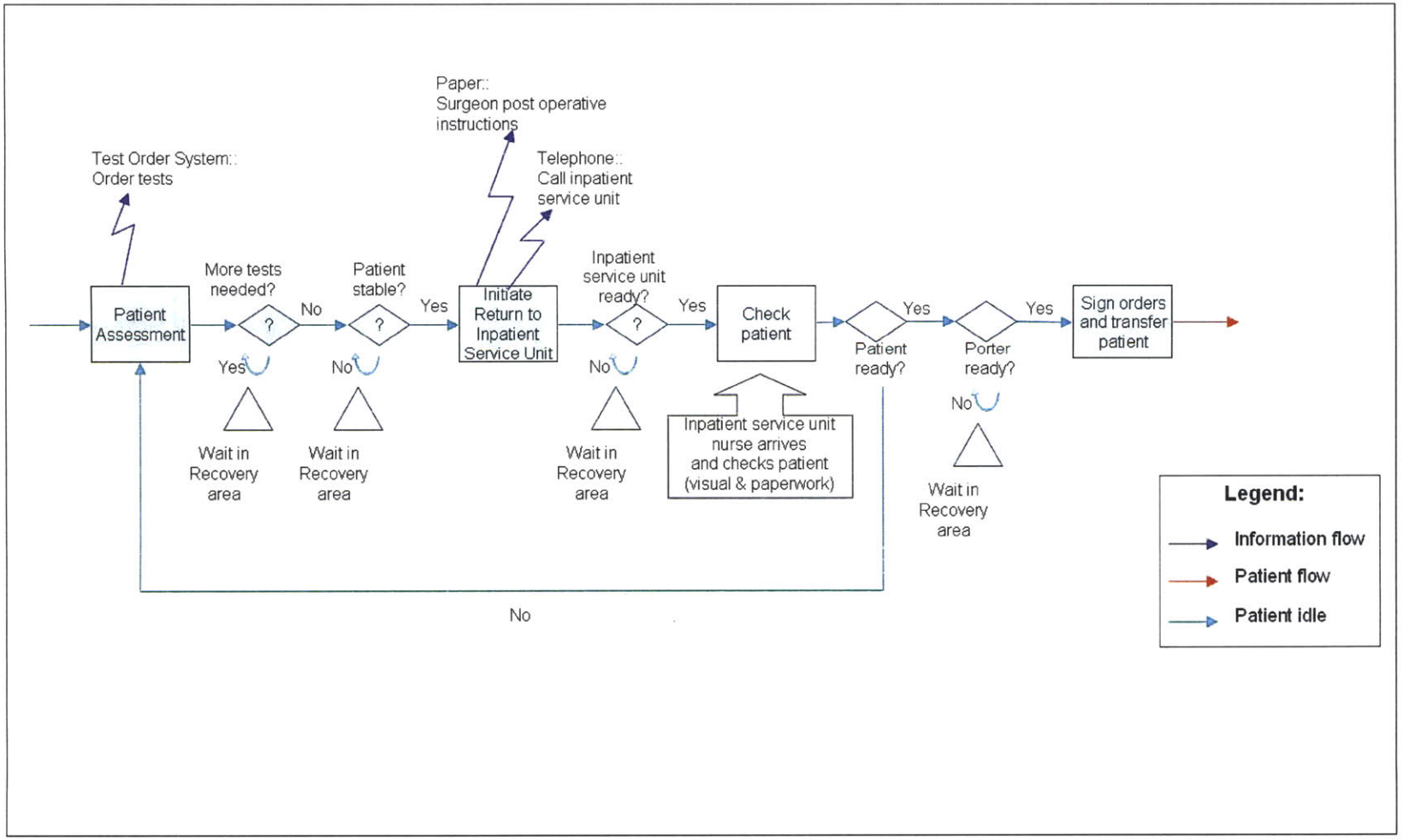

Figure 8-2: Hospital ABC Main ORs Value Stream Map (2 of 2)

Fetch 1st patients: At the beginning of each day the Holding Bay nurse checks the operating list prepared in the previous day, and triggers the transfer of the first patients from the inpatient service units to the Main ORs (and other OR specialties). The Holding Bay is an area meant to function as a buffer between inpatient service units and the ORs, so that the ORs may call for the patient and have him swiftly available for the designated surgical procedure. The patient may be transferred to the Holding Bay either using a porter or walking on his own whilst accompanied by an inpatient service unit nurse. The transfer mode is specified in the operating list. If a porter is needed, at 7.30 am the Holding Bay nurse hands a piece of paper to different porters who then proceed to pick up patients from various inpatient service units, who are meant to undergo a surgical procedure at 8 am (i.e. the first patients of the day). Theoretically, the porters will arrive at the designated inpatient service unit and the right patient will be ready for pick up, and is immediately transferred to the Holding Bay in the Main ORs. Similarly, theoretically patients capable of walking will be adequately and timely accompanied by their inpatient service unit nurses to the Holding Bay. The target is to move patients to the Holding Bay at least ten minutes before their procedure start time.

Check in patient: When the patient arrives at the Holding Bay the Holding Bay nurse checks-in the patient. Checking-in the patient implies specifying the patient's temporary location within the Holding Bay, signaling in the Main OR computer system that the patient has arrived, and phoning the anesthesiologist who will be responsible for inducing the patient before, during, and after the procedure.

Anesthesiologist verifies patient: The anesthesiologist designated to the patient's case comes to the Holding Bay and proceeds with the verification of the patient. Is it the right patient? Has the patient signed his or her consent to undergo the procedure? Are the required tests complete (e.g. blood work, imaging, etc)? Has the patient fasted? Is the patient cold and cough free? If any of these questions has an unfavorable answer then the procedure has to be delayed and the Main OR Coordinator needs to become involved. A decision is made as to whether to keep the patient in the Holding Bay while making last minute arrangements (e.g. signing consent form), or to cancel the patient's procedure,

move him back to the inpatient service unit, and bring the next patient on the operating list.

Holding Bay triggers patient fetch: A patient's procedure may have been cancelled or is in the process of finishing, hence the Holding Bay nurse phones the inpatient service unit where the next patient is located and warns them that a pick up is about to take place. Ideally the inpatient service unit already has the next patient ready, and if so the Holding Bay nurse hands a piece of paper to a porter who then proceeds to pick up the patient from the designated location, and brings he or she to the Holding Bay. If however the inpatient service unit says that the next patient isn't ready, the Main OR Coordinator needs to become involved and make the decision as to whether to wait for the patient, or to proceed with the next case on the list. Please note that the reshuffling of operating lists involves a considerable amount of additional processes which will be described in further detail in subsequent sections.

Move and prep patient to OR: Having been verified as fit to undergo the procedure, the patient is moved to the OR by a porter or the anesthesiologist himself. Ideally the surgeon or a member of his team greets the patient and acclimatizes him or her for the surgery (e.g. help them with their anxiety). The patient is put to sleep and is positioned for the surgery according to the preferences of the designated surgeon. A timeout occurs before the surgeon cuts the skin, whereby everybody in the team must agree that the correct patient is on the OR table and that they know the procedure about to take place. Timeouts are a cornerstone of surgical safety and should occur every single time according to the evidence based medicine guidelines set by the NHS.

Perform procedure: The surgeon together with the anesthesiologist and the surgical team perform the procedure on the patient. An OR nurse registers the case start time on the Main OR computer system. Nearing the end of the procedure an OR nurse recognizes that the procedure is about to finish and she calls the inpatient service unit where the next patient to undergo a procedure is located, and warn them that they are finishing up the current patient. Ideally, inpatient service units are warned 30 minutes before the Holding

Bay sends a porter to fetch the next patient. Once the procedure ends the time is inserted into the Main OR computer system, and the patient is woken up while still in the OR. At the same time, an OR nurse should phone the Recovery Area and warn them that they are about to receive a patient from the OR. If a staffed recovery bed is available then the patient is moved by an OR nurse and the anesthesiologist to the Recovery Area. Otherwise the patient either remains in the OR, or is indeed moved to the Recovery Area but the anesthesiologist has to stay with him (i.e. a bed is available but a recovery nurse isn't, hence the anesthesiologist stays and can't begin prepping the next OR case).

Patient assessment: A Main OR physician checks on the patient in the Recovery Area and determines if further tests are needed in order to adequately assess the patient or if the patient needs more time to stabilize in any case. If the patient is considered stable, the recovery nurse triggers the process to return the patient to the designated inpatient service unit.

Initiate return to inpatient service unit: Once a decision is made to return the patient to the designated inpatient service unit, a recovery nurse must locate the surgeon's post operative notes (i.e. specification of drugs administered, whether solids can be ingested, etc), and then phone the inpatient service unit and inquire about their bed and nurse availability (i.e. to pick up the patient). If the inpatient service unit isn't available, then the patient must continue to wait in the Recovery Area.

Check patient: The inpatient service unit nurse arrives and checks the patient and the surgical post operative notes. If the nurse is satisfied with the patient's stability, and a porter is available to move the patient, the nurse signs the patient handoff and the patient is moved to the inpatient service unit. Otherwise the patient must continue to wait in the Recovery Area.

8.4.2 2nd Main ORs Phase: Interviews and Observation

The second phase of the Main ORs data collection and analysis consisted of five individual interviews with different clinical staff, three of which were with physicians (i.e.

two surgeons and one anesthesiologist), and two were with nurses managers (i.e. for the whole of Main ORs, and the recovery room specifically). All five interviewees allowed for audio recording. The physician interviewees were selected randomly within each category (i.e. surgeon or anesthesiologist), whereas the nurse interviewees were first theoretically sampled (i.e. had to be at managerial level for their respective function) and then randomly selected (i.e. each function had two or more possible nurse managers). The interviews took place in different settings. The nurse interviews took place inside their Main OR office. The anesthesiologist interview took place in the Main OR Coordinator office, as anesthesiologists don't have an office in the Main OR. Finally, the surgeon interviews took place in their own offices which were located in different buildings than that of the Main ORs.

The interview process was informed both by the 1st Main ORs phase described in the previous section, as well as by the emerging Nightingale-Rhodes Enterprise Architecture Framework (NREAF) described in Chapter 3, and already refined in Chapter 8 (i.e. resulting from the analysis of Hospital XYZ's in-depth case study)[154]. As such preliminary interview questions were asked pertaining to each of the EAF views (i.e. External/Policy; Strategy; Process; Organization; Knowledge; Information; Service/Product) while leveraging specific observations from the 1st Main ORs Phase and allowing for each interviewee to provide depth in those EAF views which he or she found most relevant . Additionally, interviewees were implicitly and explicitly probed on specific insights generated in the previous chapters (e.g. assessing the interaction of their service unit with other service units; evaluating the existence of multiple internal architectural configurations; etc).

Figure 8-3 is an overview of our characterization of Hospital ABC's Main ORs sub-architecture which emerged from the data analysis presented in the next subsections. This characterization concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the Main ORs) as well as enterprise level (i.e. pertaining to Hospital ABC

[154] The Chapter's main text will include key interview excerpts to support the findings from the analysis. For additional excerpts please refer to Appendix V(i.a).

as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[155]). The circle placement of the EA Views is meant to illustrate that they are interconnected.[156]

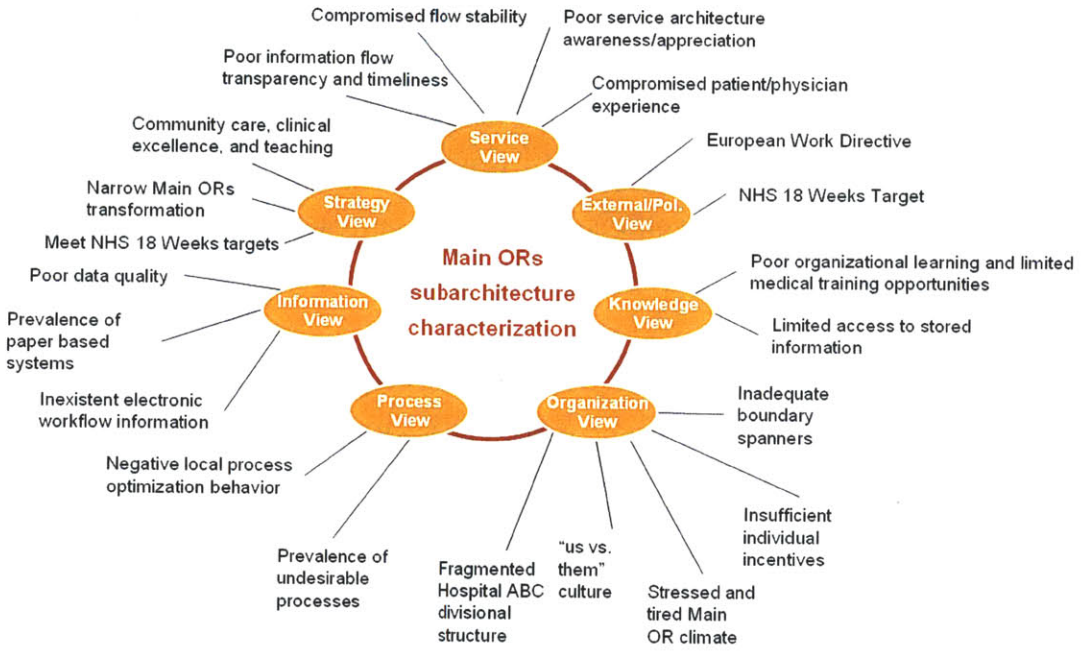

Figure 8-3: Hospital ABC Main ORs sub-architecture characterization

8.4.2.1 Main ORs External / Policy View

In describing Hospital ABC's external environment all interviewees were consistent in referring to the pressure of meeting the 18 Weeks target set by the NHS and how it in turn was placing the Main ORs under close scrutiny by senior management. Essentially they felt that they were having to increase throughput with only the incentive of being able to maintain Hospital ABC's reputation and referral base[157].

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[155] See section 7.7.2.

[156] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 8.4.3 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions.

[157] The NHS publically published compliance data on how well each individual hospital was meeting the 18 Weeks target. Such data, being publically available, was meant to be reviewed by patients with their primary care physicians, who would then potentially elect to seek treatment at hospitals who were

However there were other influential external factors which lied beyond the NHS. Specifically, a recent European Work Directive dictated that junior doctors could only work a maximum of 48 hours per week, rather than the previous non-limited labor arrangements that allowed for as many as 100 hours. The implications of such a severe reduction were significant in that junior doctors are responsible for a considerable amount of processes that help provide care to patients within and beyond the OR. Moreover, clinicians felt that on one hand 18 Weeks was asking them to do more with their existing plant, while on the other, they had even less resources associated with the plant. As such, the surgeons expected that Hospital ABC's senior management exercised its Foundation Trust status and implemented internal solutions that would allow then to adequately respond to the external pressures.

In describing their regulatory environment at a clinical level several pertinent observations were made. To begin with, it was clear that both surgeons and anesthesiologist described themselves as autonomous agents, whereby they didn't necessarily have to follow evidenced based medicine guidelines set by external entities[158]. Indeed they acknowledged their existence but they opted to follow their own individual or group practices. For instance, the guidelines recommend that surgeons perform what is called a *timeout* before the start of a procedure, whereby he or she reviews what is meant to happen and seeks everyone's acknowledgment and approval (e.g. make sure that the correct side of the body is being operated on). However, one particular surgeon simply refused to be present to do a timeout.[159] In their own defense, the surgeons argued that the guidelines were too high-level and couldn't apply to their particular subspecialty. Conversely, nurses described in detail several of their processes which had to abide by the NICE guidelines, and in doing so, they demonstrated a predisposition to follow them judiciously (e.g. patient handoff information requirements).

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compliant (i.e. triggering a referral), as opposed to those who weren't. Hence, the referral implications of 18 Weeks were clearly understood not only by senior leadership, but also by clinical staff.

[158] In the UK these are known as the NICE Guidelines, namely the National Institute for Health and Clinical Excellence (www.nice.org.uk).

[159] This information was also confirmed by the HMS student who was doing her surgical rotation at Hospital ABC. None of the surgeons she trained with at Hospital ABC did timeouts.

8.4.2.2 Main ORs Strategy View

The definition of strategic goals, vision, and direction of the enterprise traditionally lie with senior leadership in organizations, and indeed these were included also to that effect in the analysis of Hospital ABC's in-depth case. However, the Main OR's interpretation and receptivity of Hospital ABC's overarching strategy emerged as relevant phenomena in describing organizational behavior, as evidenced in the following analysis.

> *"For a surgeon theatres are extremely important. Main theatres have a wide range of sub specialties and you have a wide range of individuals that each of which have their own niches in developing tertiary practices. You'll see surgeons that are doing some new hip replacement, or some new something else... so everybody is developing a tertiary center as well as serving the local community. And that is difficult for theatres!"*
>
> Hospital ABC Main ORs Surgeon 1

The location of Hospital ABC is such that its surrounding local community is mostly comprised of minorities who tend to be resource deprived and are generally associated with higher indices of violence. Hence, a key component of Hospital ABC's strategy is to provide high quality care in as safe a manner as possible to its surrounding community. However, over the years, Hospital ABC has also strived to build a national and international reputation as a tertiary center, having already established a strong presence in various subspecialties. The patient population for each strategy (i.e. community vs. tertiary) is inherently different and has different requirements of the hospital's delivery platform. Moreover, Hospital ABC experiences tension in its enterprise strategy alignment, as it positions itself to care for the local community, and at the same time strives to remain at the clinical excellence forefront of various subspecialties.

The third and final key element of Hospital ABC's strategy is the training of medical students, subspecialty physicians, and nurses. Hospital ABC is associated with a leading university, and wants to remain the preferred place for training. Hence, the hospital wishes to be the first choice for both patients and trainees.

8.4.2.3 Main ORs Service View

The Main ORs' inflow and outflow interactions are part of the overall service architecture of Hospital ABC, as are the Main ORs' own internal processes. Events that take place either upstream or downstream may have significant implications in the service architecture overall.

The Main ORs staff shared a concern towards patient experience but their different perspectives of how to deliver it, compromised the service architecture[160]

All interviewees consistently demonstrated a concern towards the patient experience at Hospital ABC. Both surgeons and nurses were sensitive to the implications of having to cancel a patient's surgery. A patient will have made time from work in order to undergo and recover from surgery. The anxiety level will be high and patients will have had to be fasted and undergone a series of tests, which are only relevant if the surgery does indeed take place. However, the concern for the patient in turn created tension between nurses and surgeons when interpreting various processes of their service architecture. For instance, the Holding Bay is by definition an area in the Main ORs meant to hold patients, such that when the ORs are ready, they can be swiftly moved to the ORs. The surgeons and anesthesiologists were unanimous in their assessment that the Holding Bay is a good thing to have. Conversely, the nurses argued that patients are very uncomfortable once there because they aren't allowed to use the toilet, to watch TV, or to be with their families. Moreover, nurses suggested that surgeons abuse the holding concept, whereas surgeons complained that nurses refused to hold patients. Ultimately, in both scenarios, stakeholder behaviors were adversely impacting patient experience (e.g. slowing down operations and potentially contributing to the cancelling of surgeries; holding patients unnecessarily for too long). From a service architecture standpoint, the ideal would be to have the patient arrive at the holding bay in a timely manner, and in a reasonable timeframe be transferred to the designated OR.

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[160] The coding of both qualitative and quantitative data allowed for the categorization and sorting of emergent phenomena of interest, while analyzing the data informed by the lean enterprise principles. The results of said analysis are several key findings, which we highlight by underlining, and pertain to the text immediately following each finding. Notably, some key findings were derived from larger sets of data, which generated sub-findings that we highlighted in **bold**, and together support the key finding underlined. Moreover, neither underlined nor bold segments are meant to be recommendations, but rather, reflect our findings from analyzing the collected data.

"Due to [the] holding bay the sending issue is no problem for us... so we can send for a little bit earlier than when we usually need the patient actually. This is a very helpful device"

Hospital ABC Main ORs Anesthesiologist

"The idea of a holding bay is that they hold a patient until surgery. In terms of patient comfort and dieting it pays not to leave them down here for a long time. They want to go to the toilet and we don't have a patient toilet [down here]. We don't have facilities for them to watch TV."

Hospital ABC Main ORs Matron

Misaligned processes and poor information visibility beyond the Main ORs compromised both patient care and patient flow

Further insight was derived when considering Hospital ABC's service architecture, and in particular the alignment of processes and information visibility across different service units. These affected both the inflow and outflow of patients to and from the Main ORs. With regards to inflow, by definition, elective care implies a joint patient and surgeon decision to perform some kind of procedure on a given date. Also, depending on the type of procedure, a surgeon will know whether or not the patient will need a high dependency unit (HDU) bed after undergoing the procedure. However, knowing the schedule and associated resource requirements ahead of time is insufficient to ensure a timely start of the OR operations. One of the surgeons referred to the issue of bed availability possibly changing during the night (e.g. an emergency patient visited the emergency department and was admitted to the hospital), and not being able to readily know the next morning whether or not that is the case. Two key factors were contributing to this situation. First, while some surgeons begin their day at 7 am with the intent of starting the OR at 8 am, HDU nurses only begin their shift at 8 am or later, hence their schedules aren't aligned with OR start times. Similarly, physicians don't have a standard time to visit the HDU area to evaluate patients, thus stable patients may remain longer than necessary in the HDU. Second, the underlying information technology architecture doesn't support workflow, so much so that bed availability is done on the basis of a visual count.

With regards to outflow, the Recovery Area nurse elaborated as to how difficult it can be to track down inpatient service unit nurses to collect patients that have been deemed stable enough for discharge from the Main ORs. Once again the issue of misaligned schedules is mentioned (e.g. patient rounding; nurse lunch breaks; etc), although capacity constraints may also be contributing to the poor service unit interaction.

> *"You know it would be lovely if you sat in recovery and see what we have to go through. Of course they know [that we have a patient ready for pick up], but for some reason they are either [administering] drugs, or they have gone on their lunch, or it is just one qualified nurse on the ward... they can't come. [...]We give them 20 minutes notice. And after 20 minutes we ring them again. We can wait up to 2 hours sometimes"*
>
> Hospital ABC Main ORs Recovery Area Nurse

Ultimately, misaligned schedules and fragmented information systems generate poor information visibility which complicates the management and effective utilization of the overall service architecture.

<u>Misaligned processes and poor information visibility within the Main ORs compromised both patient care and patient flow</u>

Theoretically the first Main OR cases are scheduled for 8 am each morning. However, all junior physicians (i.e. still in training) who manage a considerable amount of flow processes, only start their shift at 7.45 am. Hence, staff scheduling within the Main ORs themselves is also compromising patient flow. However, it is important to note that Hospital ABC is also struggling with complying with the reduced work hours imposed by external policies (i.e. the European Work Directive). Nonetheless, the fact still remains that the schedules are misaligned even within the Main ORs.

A similar problem exists with the coordination of nursing schedules within the Main ORs. Specifically, nurses are allowed to go on break in between procedures, and the same nurses are the only resource available to clean and ready the OR for the next procedure. Surgeons repeatedly said that they would prefer to have one less nurse during the procedure itself, rather than have them go on break in between cases, and in doing so, slow down overall patient flow.

Further issues exist within the Main ORs with regards to poor information visibility. For instance, surgeons complained that their Main OR Coordinator is unable to detect when an OR has had its procedure cancelled and is being unused. The surgeons offered that the coordinator is too busy doing paper work or that she was only aware of her immediate surroundings (i.e. she only sees ORs nearest to her office). However, it also speaks to the poor information architecture infrastructure in place. Furthermore, when probed specifically as to whether the surgeons warned the coordinator that an OR was about to go unused, they confided that it was solely dependant on clinical staff being proactive and unfortunately didn't happen across the board.

Still within the Main ORs, a different kind of issue arises in the communication between the ORs and the Recovery Area, in that the former is meant to warn the latter when a patient is about to be woken up and moved to the Recovery Area. According to the recovery nurses, and both the anesthesiologist and the Harvard Medical Student, they aren't warned at least 25% of the time and they find themselves scrambling to find a solution. Alternatively, given the lack of communication, the recovery area assigns a bed to another patient that has since finished his or her procedure, therefore disrupting the flow of the originally intended OR. It is important to keep in mind that several surgical specialties are indeed housed within the Main ORs, but they are assigned specific ORs and are staffed with specific people. Hence, a surgical team that has just finished a patient who is now taking up space in the OR whilst awaiting space in the recovery area, cannot simply call for the next patient to be operated in a different OR.

Another bottleneck in Main OR patient flow occurs due to surgeons not providing post operative notes and leaving the premises. Said notes are a requirement to fulfill the patient handoff between the Recovery Area and an inpatient service unit nurse collecting the patient. However, as much as 50% of the time recovery area nurses have to track down the paper post operative notes. All in all, the lack of communication between Main OR units (i.e. OR and Recovery Area) leads to suboptimal decisions that may compromise the service architecture as a whole.

"Half the time we have to go looking for them or we then find that the surgeon is gone and nothing has been written, and that is a big headache. And sometimes we get a ward nurse to get the patient and she will not take the patient without the notes, which we can understand. So the patient then ends up in recovery far longer than is necessary really."

Hospital ABC Main ORs Recovery Area Nurse

Inadequate inpatient service unit processes were contributing to the Main ORs cancellation rate

Main ORs interviewees consistently said that the inpatient service units significantly contributed to the Main ORs existing 9% on-the-day cancellation rate. The key reasons quoted for the cancellations were that patients weren't pre-assessed properly, that they weren't consented, or that they weren't worked up properly. Both the author and the HMS student had the opportunity of frequently observing and verifying this phenomenon taking place. All of the abovementioned tasks are meant to be done before the patient is transferred to the Holding Bay in the Main ORs. For instance, a patient who has a cold, or who has not fasted, cannot undergo surgery. Similarly, no procedure can begin without a signed formal consent from the patient, stating that he or she understands the risks involved, and that a physician has explained these carefully. Finally, test results may take up to 4 hours in processing time, hence if they weren't requested in the previous day, there is no way that said patient can undergo surgery at the beginning of the day.

Interdependent service units demonstrated poor service architecture awareness in day-to-day operations

In Chapter 6 we introduced the concept of service architecture awareness and argued that it should be embedded at all levels of the hospital enterprise and inform the planning and execution of improvement initiatives, transformation plans, organizational learning, and performance measurement in general. In analyzing the Main ORs at Hospital ABC it became apparent that developing service architecture awareness is equally important at the individual level in day-to-day operations. The following are two of the key examples described in this section with regards to a generalized lack of service architecture awareness at the individual level:

- Interdependent service units establish their schedules independently, which leads to poor information visibility and availability, and ultimately compromises patient flow.
- Interdependent service units neglect to update adjacent units in their flow and provoke last minute troubleshooting and further delays

8.4.2.4 Main ORs Process View

Service architecture dysfunctionalities generated localized process optimization behaviors

Earlier we mentioned a service architecture dysfunctionality stemming from misaligned schedules and poor information system capability (see section 8.4.2.3). However, other types of service architecture dysfunctionalities were identified and found to generate localized process optimization behaviors. Essentially, a stakeholder optimizes his or her local processes without regard to the potential implications upstream or downstream. The following are examples of such behaviors:

OR calling for patients too early: Surgeons and anesthesiologists generally preferred to call patients earlier than needed in order to make sure that the inpatient service units made them available on time, hence hopefully lessening the potential for delays (i.e. the more warning we give them, the more time they have to make sure that the patient is here when we need him). However, this not only conflicts with the nurses understanding of what is reasonable in terms of patient experience (i.e. the Holding Bay isn't recommended for patients to remain extended periods of time), but also pressured inpatient service units in a potentially untimely fashion (e.g. they could send the patient to the Main ORs without fully working them up or getting their surgery consent).

Poaching of surgical kits: The advantage of elective cases, and in particular those that are standardized and have been done a considerable number of times, is that surgical kits can be prepared ahead of time for a particular surgeon. However, a prevailing practice was that nurses were poaching surgical kits from other ORs in order to be able to find specific instruments required for their own OR.

Surgeons generating overly ambitious lists: Establishing an operating list schedule necessarily depends on how long each surgeon thinks his procedures will take. What happens is that some surgeons will be over-optimistic (i.e. schedule too many procedures) so as to trigger the necessary processes to get patients ready (i.e. order tests the night before), etc, and by design plan to overrun into another surgeon's OR slot, or require staff to remain longer at the end of the day. Moreover, their localized optimization behavior is adversely affecting overall patient flow as well as placing additional pressure on OR staff.

Recovering Area calling inpatient service units too early: In the case of non-major procedures (i.e. those that require ICU beds) surgeons feel comfortable with initiating a procedure even without a Recovery Area bed being available. As procedures near the end and the Recovery Area nurses find themselves without a bed and/or staff for them, they feel pressured into calling inpatient service units too early, so as to make sure that they are readily available to pick up one of their current patients. However, this may lead to further delays because nurses might be called and the handoff documentation isn't ready yet (e.g. post operative notes not available), and in some extreme cases patients have yet to be considered stable enough to be transferred (e.g. recovery area nurses hope that inpatient service unit nurses accept an unstable patient).

<u>Service architecture dysfunctionalities caused last minute suboptimal decisions</u>

In some cases, rather than generating systematic localized process optimization behaviors, service architecture dysfunctionalities call for last minute decisions, which may ultimately also have suboptimal results.

Reshuffling an OR operating list pressures other service units: Amid a last minute cancellation, surgeons have to change the order of their operating list. This means that a patient that was only meant to be called from the inpatient service unit later in the day, all of the sudden has to be made ready as soon as possible. Understandably, such a decision impacts the operations of several other service units (e.g. patient may still be undergoing tests; the patient might have not yet arrived; the patient might have not yet been rounded on by the clinical staff; etc) and has the potential of further slowing the ORs workflow.

Reshuffling an OR operating list pressures the surgeon: Surgeons traditionally schedule their hardest cases first, as they feel that they are better able to perform, and are more likely to have a positive outcome. By switching around patients in the operating list, the surgeon more often than not, finds himself starting the day operating on a less complicated patient, which isn't ideal.

> *"What we now end up doing is that we put a small case first. But if you ask me when do I operate best it is first thing in the morning. I get more done efficiently in that time than I do later in the day. There is no doubt about that in my mind."*
>
> Hospital ABC OR Surgeon 1

Misaligned service unit schedules constraint resources: Previously (see section 8.4.2.3) we mentioned how interdependent service units had misaligned schedules which were affecting OR start times. In some cases, surgeons took it upon themselves to physically visit the high dependency service unit and check the bed availability. In other cases, if an HDU bed isn't readily available, some surgeons were reported to have already *gambled* the start of their OR with a major procedure, based on their unofficial assessment of those patients currently in the HDU, and awaiting to be seen by the HDU team later in the morning. Besides potentially running into an HDU shortage when a major case is finished, surgeons were stepping on other service unit *turfs* which ultimately didn't contribute to amicable cross unit relationships.

Non-dedicated inpatient service units: Often times, patients are discharged from the Main ORs Recovery Area to a different inpatient service unit than the one they originally came from. Inpatient service units are unable to centralize patients of a particular type, hence they have to accommodate a great mix of specialties. There are several advantages in doing the opposite, including the ability to appropriately staff nurses (i.e. the skill set required of surgical nurses is quite different from medicine nurses), and maximizing physician rounding (e.g. physicians are of a specific specialty which have specific patients, and if these are centrally located, physicians can more readily round on them).

Recovery Area staffing: Recent improvements to the Main ORs included increasing the number of beds available in the Recovery Area. However, more often than not, the bottleneck caused by the Recovery Area isn't because of a lack of beds, but rather a lack of nurses to staff the beds. As a result, patients may be transferred from an OR to the Recovery Area because there is physical space, but the anesthesiologist has to remain in the Recovery Area given that a nurse isn't available. This is understandable in that both surgeon and anesthesiologist want to clear the OR and allow it to be cleaned and readied for the next procedure. However, three issues can be observed with this approach (and which signal the practice of costly last minute decisions). First, there is an anesthesiologist shortage at Hospital ABC, which implies that the anesthesiologist that stays in the Recovery Area is unable to prepare the next patient, hence the procedure is delayed.[161] Second, the salary structure in the UK is such that nurses earn considerably less than anesthesiologists and surgeons, therefore it would make more sense to hire more nurses, and adequately staff the Recovery Area. Third, a non-operational OR not only implies the potential of cutting short its operating list, but also implies that all its staff (e.g. nurses, surgeon, junior doctors) are idle.

OR turnaround: the same nurse team that assisted in an OR procedure is meant to help setup the next procedure, as well as clean the OR, therefore contributing to a longer turnaround time. At first such might not be detected as a problem since the patient flow is already sufficiently disrupted when considering the interaction with inpatient service units. However, should said interactions indeed flow adequately, the OR turnaround time would prove to be unnecessarily long.

<u>OR scheduling complexity required considerable effort to make adjustments</u>

When scheduling a procedure many factors have to align themselves perfectly across multiple service units and organizational structures. Some of these include: an OR being available; the surgeon agreeing to perform the surgery; the patient being available, properly assessed, consented, and worked up; nursing staff being allocated to the OR;

[161] Note that prepping a patient with anesthesia may take anywhere between 8 to 90 minutes depending on the complexity of the procedure.

recovery beds being available; etc. Understandably, accommodating last minute scheduling adjustments (e.g. cancelling one procedure and calling for a different patient) requires a considerable amount of time and effort. In some cases it may take as long as 90 minutes to make the readjustment, requiring the involvement of surgeons, coordinators, anesthesiologists, etc, and all the while, it may prove to be too late in the day to actually go ahead with the new procedure (i.e. it would imply an unreasonably overrunning list).

> *"It takes 90 minutes fighting to get people to move from one theater to another... Which usually at 3 o'clock you don't even need to fight for 90 minutes, because 90 minutes later you can't start the case anymore."*
>
> Hospital ABC Main ORs Anesthesiologist

> *"there is a bit of micro managing because we don't want to lose 1.5 hours and [instead] get another patient in that slot."*
>
> Hospital ABC Main ORs Matron

Non-standardized and unclear processes compromised patient flow

When taken to an extreme, local process optimization behaviors reside at an individual level and essentially prevent the use of standard processes and require even more resources unnecessarily. Examples include:

Non-standard requirements: Different anesthesiologists although covering the Main ORs for the same subspecialties, have different requirements of the nursing staff. For instance, while some anesthesiologists want to be called immediately as a patient arrives at the Holding Bay, others first want to check their equipment and then see the patient. As such nurses have to keep track of all the individual preferences and make sure that they abide by them. Similarly, anesthesiologists complained that not only different surgeons have different requirements for exactly the same procedure, but also are inconsistent at an individual level. In other words, surgeons may change their mind last minute as to how they want a patient positioned, thus forcing anesthesiologists to start all over again. Notably, the HMS student verified thorough observation that this was indeed happening.

Non-standard process definitions: Interestingly, when comparing the process descriptions from nurses and surgeons as to how the next patient being operated on is called for from the OR, these were different. Whereas the surgeon sees himself responsible for triggering the process, the nurse said that nurses were responsible for detecting when the case was about to finish, and then trigger the process themselves. Moreover, it is unclear who is meant to do what in terms of assuring that the next patient is called for, which consequently may adversely impact patient flow.

Similarly, the Recovery Area nurse said that at least 25% of the time the ORs don't warn her staff that they are going to bring them a patient. Indeed the anesthesiologist recognized that this was the case and that human error was at play. However, it could also well be that once again each OR team does it differently, and different people have different interpretations as to who is responsible to make the phone call, and in what time frame it should be made.

Finally, another example pertains to the post operative surgical notes. Some surgeons elect to fill them out by hand (which may be at times difficult to decipher), while others use their own word processing software (which may delay their availability at times). Furthermore, different surgeons have different standards as to what they write on their notes, and according to the Recovery Area and inpatient service unit nurses, it isn't uncommon for them not to signal whether or not patients can eat or drink in a given timeframe (i.e. a basic requirement for a successful patient handoff). Ultimately, nurses find themselves having to track down surgeons in order to get the information that they need and adequately finalize a patient handoff.

> *"A lot of the times we have to go chasing for the notes. The surgeon forgets to write the notes. We then have to ring. You have to go to the switchboard to find where they are. That can take a big chunk of time to find where they are."*
>
> Hospital ABC Main ORs Recovery Area Nurse

The Main ORs experienced tension between enabling team stability and maintaining operational flexibility

When discussing process complexity, surgeons referred to two factors in particular, namely the composition of their team and the nature of the procedure itself. There are procedures that have become standardized to the point that surgeons know ahead of time all of the materials that are required, and with the aid of a stable team they can operate like a focused factory. However, if the team composition changes it necessarily has a potential adverse effect on both standard and non-standard procedures, because the staff will be less familiar with the needs of the particular surgeon.

Conversely, the anesthesiologist observed that stable teams may indeed help a surgeon but they may also hinder operational flexibility. Currently Main ORs are staffed such that the same pool of staff is assigned to the same set of ORs, and cannot be rotated as needed to other ORs. Therefore, in the event that one OR finishes early (i.e. its staff become available), and another OR of a different type is available (i.e. capable of accommodating an additional patient undergoing a different procedure), the OR capacity will remain unused. We offered that perhaps the staff was associated to specific ORs because of their skill set, but both surgeons and nurses agreed that nursing staff could conceivably assist at any of the ORs. Hence, it seemed that surgeon preferences over team stability were taking hold over operational flexibility.

The Main ORs experienced performance measurement process and content issues

When probed in terms of performance measurement practices, surgeons consistently referred to them as reactive, incomplete, and lagging. Reactive because only in the event of an audit would they look closely into a particular metric whether it be quality or operations related. Incomplete because surgeons expressed an interest in accessing financial related data (e.g. how much income is the department generating for Hospital ABC?) but were consistently denied access by senior management. Finally, lagging because information isn't presented in real time (i.e. reinforces the reactive approach to performance measurement). Ultimately, the underlying information system capability may also undermine the ability to have ready access to robust performance related data.

However, it is clear that the data indeed being tracked by senior management isn't being shared across the enterprise.

External policies significantly constrained key Hospital ABC processes

Detailed process level explanations concerning patient flow allowed us to further appreciate the complexity and some of the inherent resource constraints present in the Main ORs. For instance, surgeons recognize that junior doctors are essential to manage the communication with nursing staff, scheduling the OR, and managing ancillary tests. However, once again surgeons made reference to the constraints imposed by the European Work Directive and how they had to do more with less.

8.4.2.5 Main ORs Organization View

The Main ORs' local organizational climate was characterized as its staff being generally frustrated and tired (i.e. *worn out*)

All interviewees, whether physicians or nurses, expressed frustration and tiredness in coping with system dysfunctionalities within and beyond the Main ORs.

The OR matron (i.e. most senior nurse) alluded to the fact that operations relied on the continued dedication of the nursing staff, and that these were beginning to feel burnt out and leaving Hospital ABC. For instance, on top of the normal pressures of assisting surgeons and patient flow, nurses would have to compensate for missing surgical kits and sterilize them last minute, when supposedly these were meant to be provided by an external service provider. Similarly, the Recovery Area nurse expressed her difficulty in managing her unit's staff shortage, and also commented on how the inpatient service units are stretched thin and less able to support patient flow.

As for physicians, both surgeons and anesthesiologist felt that they had to spend an unreasonable amount of time troubleshooting system issues, when what they should really be doing is operating and caring for patients. Examples included the difficulty in getting patients to the Main ORs in a timely fashion, and being able to discharge them from the inpatient service units so as to keep a stable flow. Additionally, surgeons took it

upon themselves to check bed availability in other service units (i.e. compensate for the poor information systems and the misaligned schedules across service units). Similarly, surgeons wanted to institute practices where they didn't have to rely on the system (e.g. process chain of nurses sharing information to trigger a patient transfer) and instead they wanted to bypass the system and do it themselves. Ultimately, surgeons felt frustrated with the inability to maximize Main ORs throughput as it compromised their desire of building clinical excellence and serving the surrounding community. Said frustration drove them to seek further control and if possible rely less on others for specific key processes that impact patient flow.

> *"I go to HDU to sort out the HDU beds. I see who is wanting what beds. I don't have time for this! I shouldn't need to worry about it... I shouldn't need to think have I got an HDU bed. If you were to ask me what do I do best? What I do best is to operate... my job is not to work out and run around... Actually that is more stressful than is the operating."*
>
> Hospital ABC Main ORs Surgeon 1

> *"We rely on good will day after day... if you burn them out... they leave"*
>
> Hospital ABC Main ORs Matron

> *"The ward nurse arrives, the ward nurse is stressed and would like to get back to the ward because they have got work to do, and sometimes because there isn't a porter they leave."*
>
> Hospital ACB Main ORs Recovery Area Nurse

<u>The Main ORs culture was supportive of Hospital ABC's strategic tension and mission</u>

When describing Hospital ABC's strategy, the surgeons explicitly mentioned that a tension exists between serving the surrounding community and striving for national and international clinical excellence recognition. Further analysis didn't yield a preference for one particular element of Hospital ABC's strategy. In other words, surgeons were openly concerned and devoted to serving the surrounding community, but also were vested in developing their clinical excellence niches. As for nurses, they didn't make a distinction between patient populations and emphasized the importance of providing the best patient

experience possible for any patient at Hospital ABC. Notably, one could argue that such is in line with the nature of the nursing profession which is centered in caring for the patient and assisting physicians and surgeons, who in turn are also contributing to furthering the boundaries of clinical excellence.

> *"service delivery at the highest level of care and safety for the community... that is clear... and especially in [in this area] where we have a strong diversity population catchment. We have all levels of wealth... it is something absolutely special... we are proud"*
>
> Hospital ABC Main ORs Surgeon 2

Hospital ABC had a fragmented divisional structure and experienced a considerable organizational divide amongst senior leadership, management, and clinicians

The interviewees in this phase were all clinicians and from their perspective they evaluated the relationship with the senior leadership and management structures. Unlike academic medical centers in the US where clinicians commonly hold the most senior level positions, at Hospital ABC, and indeed most hospitals in the UK, senior leadership were non-clinicians[162]. Similarly, Hospital ABC's division directors were non-clinicians, and most people in coordination positions were also non-clinicians.

When referring to the Chief Executive Officer (CEO) all interviewees spoke positively of him and the surgeons in particular said that he had been instrumental at the beginning of his tenure. However, over time, and with regards to leadership and management in general, there was a visible separation between clinicians and *them*. Several factors were said to contribute to this separation, starting with the geographic distance between offices and the look and feel of the offices. Whereas senior leadership were housed in new buildings with pretty corridors, the clinicians had their offices in run-down settings. Such was verified by observation by the author. Furthermore, surgeons felt that they seldom saw senior leaders and at best only had meetings with division directors and their coordinators. Ultimately, clinicians spoke of a physical and cultural divide between

[162] With the exception of the Medical Director, which is the US equivalent of Chief Medical Officer.

themselves and both senior leadership and management.

> *"[the CEO]... he has really been a great, great support. [...] so even before signing my contract he was surprisingly that interested. And after a couple months we are working, had full support... it was amazing. He had an open mind. [...] Manager and surgeon, it is like dogs and cats... they are not hating each other but they have big misunderstandings... certainly [they are] not on the same boat... Even if the operation is extremely good you can sometimes possibly feel, perceive that the feelings are, that, those bloody surgeons think about just the money and the managers are in the office and they know nothing about patients."*
>
> Hospital ABC Main ORs Surgeon 2

Finally, as previously noted, Hospital ABC is comprised of eight divisions which may have dedicated resources and/or shared resources. In describing the relationship across division boundaries, both surgeons and anesthesiologist spoke of independent, compartmentalized, and potentially redundant thinking. Interviewees suggested that each division worked towards maximizing its own operations and didn't share experiences or concerns with the remaining divisions.

> *"I know strictly care group or department are quite independent and everybody looks at his own door and doesn't care really and nobody really cares to what happens to a neighboring department. You can have exactly the same issue... but everybody works in quite closed compartments and it can be in the same department, or in the care group, or in the division, but it is really a water tight wall."*
>
> Hospital ABC Main ORs Surgeon 2

<u>The Main ORs exercised limited control and influence beyond their service unit boundary</u>

When probed specifically with regards to the misaligned schedules across service units (see section 8.4.2.3) the surgeons spoke of their failed attempts to rectify the situation in the past. Whereas in the context of their ORs they were supported by clinical staff to work longer hours if need be, in the context of inpatient service units they had unsuccessfully tried to have earlier nursing and medical rounds.

Similarly, operating list scheduling adjustments were described as complex and human resource intensive because of the number of organizational structures and the various levels within them. The Main ORs Coordinator not only had to somehow seek approval from the various structures (e.g. nursing manager, division director, anesthesiologist manager, etc) but also had difficulty, as a non-clinician, requesting surgeons to abide by the suggested list adjustments.

> *"There is no reason why they couldn't be done earlier. I think the nursing staff should have a 7 o'clock round, and at 7.30 you do the medical round. BANG! That culture needs to change. That would have a major impact."*
>
> Hospital ABC Main ORs Surgeon 1

> *"[There are] too many levels of responsibility. So there is not shortcut through the system. [The Main ORs Coordinator] can't tell the consultant surgeon anything that he won't do right now. It sometimes means that the surgeon has to wait for 10 minutes for something, and he will go mad about that and he will insist "no this is my list... I want this theater now". At that stage, you need a person who is capable of saying to another consultant "no, you are wrong, we need the theater now, and you get theater 5 in 10 minutes"."*
>
> Hospital ABC Main ORs Anesthesiologist

<u>Boundary spanners between the Main ORs and inpatient service units were inadequate</u>

Perhaps related to the limited control and influence beyond service unit boundaries, was the assertion that the link between the Main ORs and inpatient service units was only as strong as the checklist carried by the porters transferring patients across units. In other words, the tie across service units was considered weak, and in the particular case of porters, these were unable (or indeed unqualified) to prevent needless patient transfers (e.g. sending a patient to the Holding Bay when the consent form hasn't been signed, or when test results are still missing).

> *"overall there is a big mix of patients in the ward and no communication between the wards or little communication with theatres. [...] in terms of no strong ward culture and*

no link between ward and theatre, then I say there is no link... the link is a porter with a form with a ticking box on either side to make sure everything is safe... but it is not strong."

Hospital ABC Main ORs Surgeon 2

Boundary spanners between Main ORs and ancillary services were adequate

Unlike the link between the Main ORs and inpatient service units, the link with ancillary services works well. Junior doctors with varying levels of experience, and more or less monitoring from senior doctors, are capable of adequately managing teams of ancillary services. Similarly, nurses in Recovery Area feel that they have a good connection with ancillary services.

"The juniors put the lists in, they talk to radiology and tell them that we need imaging... This all depends on the middle grade who basically tell the housemen what to do and they implement it.... They communicate with other teams. All this revolves around how good your middle grade is If your middle grade is very experienced then they do doctor level... if they are not experienced then you need to take more control...."

Hospital ABC Main ORs Surgeon 1

"We have to communicate with radiologists because the xrays are performed in recovery... we get along with them very well, never had a problem."

Hospital ABC Main ORs Recovery Nurse

Main ORs local organizational culture was inconsistent amongst different roles

We have already described the existing organizational divide between the Main ORs and both senior leadership and management. An analysis within the Main ORs allowed to determine different tendencies in the relationships amongst various stakeholder roles:

- Both physicians and nurses thought little of porters and their ability to contribute to a stronger link between the Main ORs and inpatient service units. Interestingly, porters aren't meant to make decisions as to whether they should transfer a patient or not. They merely follow orders. However, clinical staff holds them accountable for the unreliable actions of other clinical staff (e.g. transferring a patient who

isn't ready).

- Surgeons described themselves as having big egos and were comfortable in seeing themselves as such. They noted that at times there were differences in opinion amongst them and that the Medical Director had to become involved. However, there was a general sense that surgeons were respectful towards each other.
- Nursing staff was cohesive and respectful of each other, regardless of their function within the Main ORs (i.e. Holding Bay, Recovery Area, ORs, Matron). Similarly, both nurses and anesthesiologists stated that they shared a good work relationship. The same was true between nurses and junior doctors who saw themselves on the same team, and shared the objective of somehow enabling patient flow and providing a good patient experience.
- Nurses felt that senior surgeons were both distant and in some cases dismissive towards nurses. They shared that surgeons wouldn't communicate with them directly even though they were in the same room with the patient. In analyzing surgeon statements, although they understood that nurses were spread thin and indeed felt that communication should improve, they also demonstrated a clear animosity towards them (i.e. surgeons blaming and calling nurses stupid for slow turnarounds).
- Finally, whereas nurses felt that the Main ORs Coordinator was approachable and they understood her charter, both surgeons and anesthesiologist felt quite the opposite. Essentially, surgeons thought poorly of the Main ORs Coordinator and openly stated that being a non-clinician she didn't have the required skill set and credibility to manage their OR operations.

"I think it [is] probably a reflection of days gone by where "them and us" situation where surgeons were probably placed on a pedestal and nurses knew their place. It is wearing down a little but not a whole lot really"

Hospital ABC Main ORs Recovery Area Nurse

<u>Team familiarity was said to help build culture and performance</u>

Previously we described how there was tension between team stability and operational

flexibility (see section 8.4.2.4). Nonetheless, both surgeons and anesthesiologist further emphasized the importance of keeping their clinical teams as stable as possible, as this contributes to building team familiarity and ultimately improves flow and outcomes.

Specifically, whether doing difficult or simple procedures, surgeons mentioned that their clinical team was only as good as its weakest link, and that whenever a new person was introduced, he or she would be the weakest link and compromise flow and potentially also outcomes. Hence, the European Work Directive was once again mentioned as a serious constraint, as it further limited their ability to build stability with junior doctors. So much so that one of the surgeons hired a nurse in a private practice context and paid out-of-pocket for her to assist him with NHS procedures at Hospital ABC.

Furthermore, with team familiarity being built over time, surgeons felt that they were able to nurture a favorable culture amongst the clinical staff, including nurses and anesthesiologists, which had everyone on the same page. For instance, while unreasonable overrunning lists wouldn't take place, teams had a baseline willingness to finish an operating list and avoid cancelling procedures. Notably, the Harvard Medical Student was part of different teams in her surgical rotation at Hospital ABC and she noted the strong influence that some surgeons in particular, had over their clinical teams.

<u>The Main ORs staff had multiple individual incentives but generally considered them to be insufficient</u>

When describing what drove them to perform at Hospital ABC, all interviewees consistently referred to the importance of providing the best care possible to patients. Surgeons and anesthesiologist were also unanimous in referring to Hospital ABC's clinical excellence and how they valued its brand. However, interviewees also spoke of additional incentives (or lack of) which influenced their behavior at Hospital ABC.

In terms of financial incentives a key distinction existed in terms of the type of insurance held by patients. Moreover, Trusts could offer their services to both private and public insurance patients. The NHS dictated hours of operation that Hospital ABC ORs (or that

of any other Trust in the UK) should be used exclusively for patients insured by the NHS (i.e. public care). These were from 8am to 5pm during weekdays. Both Trusts and surgeons were free to use the ORs after 5pm and the whole day on Saturday, to care for private insurance patients. The ORs staff caring for patients was the same regardless of the type of insurance. However, whereas the NHS paid a fixed salary to nurses and surgeons regardless of patient volume, private insurance paid them a variable reimbursement policy. Specifically, surgeons and the Trust would earn on patient volume (i.e. the more cases they did, the more they would earn), while nurses would earn on an hourly basis. In light of this, surgeons expressed an interest in the NHS providing a volume based incentive for both surgeons and nurses, and suggested that such would greatly improve patient throughput, as demonstrated in the operating hours paid by private insurance.

Interestingly, surgeons also suggested that financial incentives need not be the only incentive. For instance, they argued that nurses should be allowed to leave early when they completed a baseline daily number of procedures. Instead, today nurses have to remain at Hospital ABC regardless of how many procedures they supported. Hence, they don't have an incentive to help throughput. Quite the opposite apparently, as surgeons noted that nurses would at times purposefully delay processes in order to get some rest. Similarly, surgeons suggested that if nurses are required to work overtime on NHS patients, that they should be allowed to use that overtime as paid vacation at a time of their choosing. Instead, management expects nursing staff to remain overtime caring for NHS patients, so as to complete operating lists, and nurses understandably offer resistance and are unhappy about the arrangement.

> *"There is no doubt if you say... this is our target, achieve 150 cases within the year, 3 cases a day, whatever, we'll make sure we give you a 10% raise in your pay pack. But the other important thing is that once people get finished they can go home and don't have to go into the other theater. That sort of change will drive efficiency through theatres."*
>
> Hospital ABC Main ORs Surgeon 1

Other incentives took form in terms of staff awards, which in some cases also had financial incentives associated to them. Surgeons could earn as much as an additional 20% of their NHS baseline salary depending supposedly on their clinical excellence appraisal. In practice, clinical excellence was appraised as a measure of a surgeon's commitment towards throughput, rather than supporting the strategic goal of national and international recognition. Nurses also had an award in terms of their dedication, and it was presented in a public forum amongst their peers. However, the financial amount of the nurse awards was insignificant as compared to the surgeon awards.

8.4.2.6 Main ORs Knowledge View

In previous subsections we have noted phenomena pertaining to the Main ORs Knowledge View. Specifically, the divisional structure at Hospital ABC is such that they work independently from one another and don't share their learning, even though they may be faced with the same issues. Additionally, surgeons emphasized how the European Work Directive had limited their ability to build team stability with their junior doctors, and adversely affected patient flow and potentially patient outcomes as well. Furthermore, whereas nurses followed evidenced based medicine practices, both surgeons and anesthesiologists admitted to follow more of an autonomous model whereby they didn't necessarily adopt such practices. Finally, some stakeholders were regarded as inadequate to fulfill their role requirements. For instance, the Main ORs Coordinator was regarded as an ineffective manager as she didn't have the necessary clinical skills to interact appropriately with surgeons, and was unable to make decisions that would enable OR flexibility and increase throughput (e.g. match nurses according to procedure needs, rather than only allocate them to specific ORs). Similarly, porters were considered an ineffective resource which was barely able to enforce a checklist when transferring patients between service units. The following are additional insights that emerged from the Main ORs data pertaining to the Knowledge View.

<u>The UK's medical training philosophy was an additional source of pressure for patient waiting lists</u>

With the benefit of the insights from the HMS student doing her surgery rotation at

Hospital ABC, we detected significant differences in the medical training philosophy in the UK as compared to the US. As before, our intent is not to compare directly the in-depth case studies. However, the differences have visible implications in hospital operations and potentially the quality of care. Generally speaking, US academic medical centers require medical residents to have an active role during surgical procedures, as opposed to merely observing and having a minor supportive role, as is the case in the UK.

One implication is that the medical and subspecialty training in the UK takes longer in the UK and it isn't uncommon for doctors to only arrive at the attending level in their late 30's and early 40's. Conversely, in the US, it is normal for doctors to become attendings in their early 30's[163]. Notably, different specialties require different years of training, but such is the case in both countries. At Hospital ABC, training was a function of each surgeon's algorithm (e.g. resident spends two years observing, and if and only if he can do X well, I will have him start doing Y), as well as the size of their operating waiting lists (i.e. training implies longer procedures, hence if the list is long there will be less training). Conversely, in the US, there is a more structured and standardized approach, where surgical residents have to log the number and type of procedures they do, in order to become certified in their respective specialty in the US.

All in all, one could argue that the UK system is more demanding of its academic surgeons, as these don't generally rely on residents to do the procedures. Similarly, although highly involved in carrying information to enable patient flow processes, residents have less autonomy to make decisions, and hence require attending doctors' oversight even for the smallest decisions. Moreover, one could argue that an operational level, Hospital ABC is more constrained than its academic medical center counterparts in the US. However, one could also argue that Hospital ABC enables better quality of care, as residents take longer to learn, and do so by observing extensively, rather than by trial and error to begin with. It is important to note that our research instruments weren't

[163] The HMS student who was part of this in-depth research will be completing her surgical residency in Obstetrics and Gynecology by age 29. After that she may elect to pursue further training (i.e. fellowship) or she could work at an academic medical center already as an attending (i.e. have responsibility for teaching others and be accountable for her patients' experience and outcomes).

designed to either compare the in-depth cases directly, or to evaluate whether different training surgical practices generated different patient outcomes.[164] However, it is safe to argue that the different training philosophies do indeed impact directly resource availability and patient flow.

> *"Essentially if I have a too big a list I don't train people... this is not the American model where the junior does the operation... Most of my operations are done by me... very few of them are done by the junior [...] The States are very different... basically the residents do the operation, the chief resident and the surgeon stands next to them and they have to go through this log work of training"*
>
> Hospital ABC Main ORs Surgeon 1

Hospital ABC, and the Main ORs in particular, had limited or non-existent formal medical training opportunities

As noted above, our intent isn't to compare directly the in-depth case studies, but in this section we find it pertinent to elaborate on key differences pertaining to their knowledge practices which have significant and unquestionable implications in their overall enterprise architecture.

Academic medical centers in the US have multiple formal training opportunities beyond those inherent in caring directly for patients inside ORs, inpatient service units, or other healthcare delivery settings. For instance, it is common practice for each subspecialty department to have weekly *grand rounds* which are a topical lecture on cutting edge evidenced based medicine. Such venues help train medical residents as well as refresh senior physicians. Additionally, medical residents are commonly required to also meet on

[164] A targeted literature review in this regard yielded sparse evidence in addressing the comparability of US and UK medical training in terms of surgical outcomes, and is deemed interesting to pursue in another context with adequate expertise and medical training (e.g. interpreting patient charts; observing and understanding surgical procedures; etc). When considering the US alone, a recent article from the American College of Surgeons studied the influence of resident involvement on surgical outcomes in American hospitals. Their conclusion was that residents were associated with slightly higher morbidity rates but slightly lower decreased mortality rates. Moreover, a patient was more likely to survive although it may imply a longer patient stay at the hospital: Raval, M. V., X. Wang, et al. "The Influence of Resident Involvement on Surgical Outcomes." Journal of the American College of Surgeons **In Press, Corrected Proof**.

a weekly basis amongst themselves and take turns in preparing a literature based discussion on an advanced topic. Furthermore, departments use both M&M sessions (i.e. procedures that somehow went wrong, hence the morbidity and mortality, and are discussed openly to avoid making the same mistake in the future). Finally, hospitals are required to have quality assurance practices which audit procedures both randomly and selectively (e.g. procedure X is meant to take 2 hours but took 4 hours instead). All in all, it is fair to argue that leading academic medical centers in the US have several formal training opportunities that continuously enhance and sustain their medical knowledge.

Understandably, with the benefit of our Harvard Medical School colleague we were able to determine that Hospital ABC has significantly different practices with regards to knowledge sharing. So much so, that when Hospital ABC surgeons were probed specifically on it, they agreed that these were limited or almost non-existent. Once again they explained that the continuous external (and managerial) pressure to maximize OR throughput, was essentially deterring them from *standing down* and investing in learning opportunities. Additionally, surgeons also recognized that there isn't an incentive for surgeons at large to support learning efforts, and even suggested that they should become contractually mandatory.

> *"I think one of the key weaknesses of the british surgery is that we did have rounds a bit like yours [in the US]. It is like a teaching hospital, but not everybody can... it is not mandatory. [...] We do have teaching rounds on Fridays but what do we normally talk about? Do we talk about unusual cases? Do we talk about evidence based practice? Not really but that is an area where that should be discussed. [...]and you know things like infection control policy, etc, and all these things that everybody forgets every six months, we would really learn about it [...]I think it is a very good idea. It has to be mandatory."*
>
> Hospital ABC Main ORs Surgeon 1

<u>The Main ORs exhibited limited organizational learning practices</u>

Both surgeons and nurses exhibited a predisposition to engage in organizational learning practices but their execution didn't lend itself to learning organization behavior.

Surgeons spoke of their continuous pursuit of perfection but felt constrained in their ability to do so beyond the procedures themselves. Moreover, fragmented divisional structures and inadequate information systems prevented them from realizing the improvements that they thought necessary. Additionally, information wasn't being shared openly amongst senior leadership, management, and clinicians. Surgeons had not only been denied access to financial related data, but they also desired real time data rather than retrospective reports. Furthermore, whilst interviewing the lead surgeons of different specialties it was apparent that they were particularly interested in improving their own specialty, as well as their own flow, and didn't really mention the need for a consorted effort or an enterprise level approach.

Conversely, nurses spoke enthusiastically of their nurse forum which brought together nurse staff from the ORs as well as the inpatient service units. At this forum they would review ongoing issues stemming from their interdependent activities, and would discuss ways to resolve them. For instance, the shortage of porters slowed patient transfers across service units, hence they were now discussing ways to have inpatient service unit nurses accompany patients who were able to walk by themselves to the Main ORs. The nurse forum descriptions sounded interesting and warranted further investigation.[165] At a local level (i.e. within the Main ORs) nurses had practices akin to organization learning behavior. For instance, nurses were required to circulate across the different Recovery Areas (i.e. Main ORs, Cardiac, Neuro, and Liver) and other functions within the Main ORs (i.e. Holding Bay). Although, such rotations were primarily meant to enhance nurse training in different specialties, they also allowed them a glimpse as to how other service units functioned. However, rotations would remain within the same type of service unit and wouldn't cross over (e.g. an inpatient service unit nurse didn't rotate to a recovery area, and vice versa).

8.4.2.7 Main ORs Information View

In previous subsections we have noted phenomena pertaining to the Main ORs Information View. Similarly, the 1st Main ORs Phase identified several key information

[165] The nurse forum in question is discussed in further detail in section 8.5

systems as well as necessary information handoffs in the patient flow as represented in the VSM. An overview of these previous insights includes:

- Hospital ABC relied on paper-based patient records which limited not only our ability to conduct quantitative analysis, but also that of physicians to readily access, search, and share patient data.
- The absence of electronic workflow information systems required the extensive use of phone communication and visual confirmation within and beyond service units. Several adverse impacts resulted from this. First, flow information was delayed or neglected altogether, which contributed to anxiety and last minute suboptimal solutions. Second, misaligned schedules prevented readily available information (e.g. number of free ICU beds) which either delayed OR start times or/and required surgeons to physically inspect another service unit and in some cases gamble that a patient one be discharged in time for a new patient. Third, junior doctors spent a considerable amount of time essentially pushing paper between surgeons, inpatient service units, and Main ORs admin staff.
- The absence of electronic workflow information systems required the extensive use of paper forms. Patient operating lists are shared in paper format between the Main OR Coordinator, the Holding Bay, the Recovery Area, as well as the paper slips carried by porters to collect patients from the inpatient service units. Additionally, the majority of surgeons writes post operative notes by hand and neglect to readily share the notes with Recovery Area nurses, therefore once again causing delays in patient flow. The same is true of those surgeons who write their notes using their own text editing software.
- The Main ORs information system was rendered useless due to extensive data insertion quality issues.
- The positive exception in terms of electronic information systems was the ordering system for ancillary services (e.g. imaging and labs) which allowed physicians to access patient results from any terminal. The problem was that no such terminals were available in the Main ORs, and the information had to be printed out in the inpatient service units' printers. Therefore, test results weren't always readily available when the patient was transferred to the Main ORs.

All in all, Hospital ABC's electronic information systems capability was very limited and required extensive use of alternative modes of information sharing that not only were error prone and introduced system delays, but also required extensive human resource dedication and ultimately demanded more of them both physically and mentally.

8.4.3 Main Operating Rooms analysis summary

In this section we presented our analysis of the Main ORs in two phases. The first phase was mainly concerned with building an initial understanding of operations and was translated into a VSM. The second phase consisted observation and of five individual interviews with different clinical staff, three of which were with physicians (i.e. two surgeons and one anesthesiologist), and two were with nurses managers (i.e. for the whole of Main ORs, and the recovery room specifically). Figure 8-4 is the overview of Hospital ABC's Main ORs sub-architecture characterization presented earlier[166].

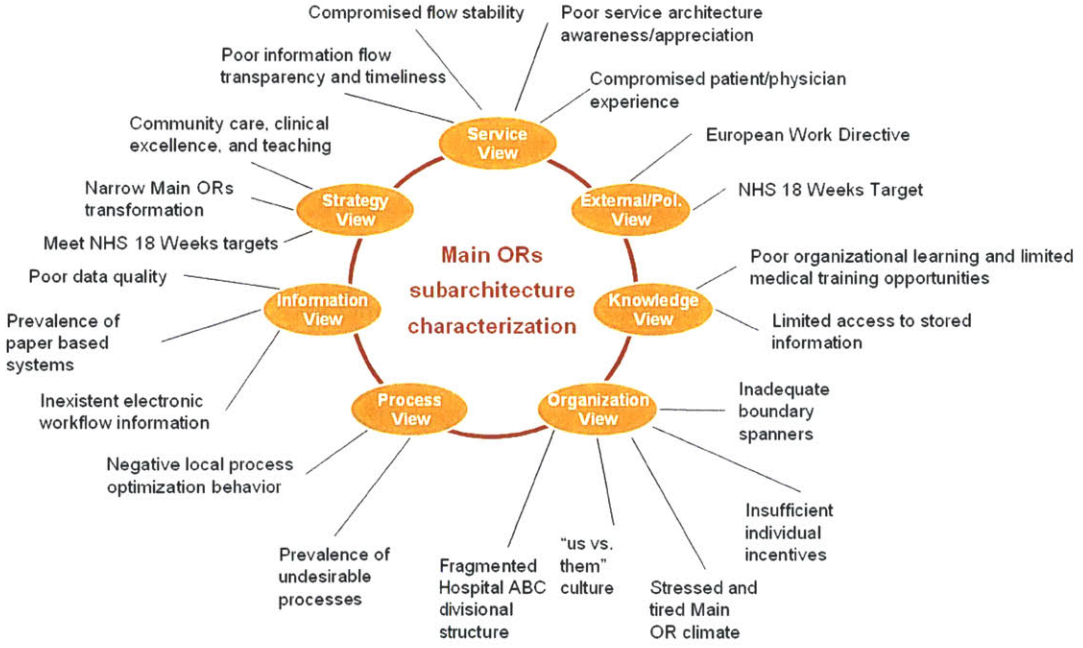

Figure 8-4: Hospital ABC Main ORs sub-architecture characterization

The characterization of the Main ORs sub-architecture concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the Main ORs) as well as

[166] In section 8.4.2.

enterprise level (i.e. pertaining to Hospital ABC as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[167]).

Hospital ABC's core strategy as a whole was to deliver care to its surrounding community while at the same time striving for national and internal recognition for clinical excellence, as well as medical training capability. The two dominant external and policy pressures were the shortening of available work hours for junior doctors (i.e. European Work Directive) and the previously mentioned NHS 18 Weeks target for elective surgery. In light of these external pressures, senior leadership at Hospital ABC had instituted as a key strategic objective, to meet the NHS 18 Weeks target across all of its divisional structures and associated surgical specialties. To that effect, senior leadership was placing considerable pressure on the Main ORs in order for them to increase their productivity given the low rate of OR utilization (i.e 75%). Additionally, very localized investments had been done in an attempt to improve the Main OR flow (i.e. invested in additional beds for the Recovery Area). However, an enriched understanding of the hospital's enterprise architecture allows us to begin realizing that the Main ORs poor performance is neither only due to its internal functioning, nor solvable with narrow capacity related investments.

From an Organization EA view the Main ORs clinical staff exhibited a stressful environment as they were well aware of the NHS 18 Weeks pressure as well as senior leadership holding them primarily responsible for the long waiting lists and for finding a solution. In evaluating the organizational climate at both local and enterprise levels, varying levels of fragmentation were evident. At an enterprise level clinicians described senior leadership and management as separate entities that weren't aligned with clinicians. Furthermore, the divisional structure (e.g. Surgery and Critical Care, Cardiac and Neurosciences, etc) replicated several functions which more often than not worked in isolation of each other. At a Main ORs level stakeholders from different groups (e.g. nurses, anesthesiologists, and managers) generally worked well together, with the

[167] See section 7.7.2.

exception of surgeons and nurses who had an arms length relationship. In terms of the link between the Main ORs and other patient care structures, these were characterized only as strong as the unskilled porters who transported patients between service units, hence the existence of inadequate boundary spanners. Finally, individuals felt that the salaried model in place was inadequately aligned with the throughput requirements. Specifically, clinicians felt that senior leadership expected them to consistently work longer hours, and they would earn the same regardless of throughput. Indeed there were other types of incentives in place (i.e. non-financial) but none of these were considered sufficient to sustain the increasing throughput demands of individuals.

From a Process EA View two dominant characteristics emerged from the Main ORs data, namely the prevalence of undesirable processes, the existence of negative local process optimization behaviors, and narrow process improvement initiatives. These characteristics had impacts both at a local and enterprise level:

- Undesirable processes are processes that may be either standard or non-standard, but that ultimately have a negative impact either within or beyond the Main ORs. Examples we discussed included the last minute reshuffling of operating lists, which among other things contributed to the pressuring of inpatient service units and ancillary services to expedite the readying of the next patient on the list. Furthermore, we described how stakeholders within the Main ORs had inconsistent process descriptions (i.e. who does what) and process requirements (i.e. what is needed).
- Negative local process optimization behaviors reflected how stakeholders within and beyond the Main ORs were making local decisions to improve their individual function, but without regard for potential impacts upstream or downstream. Examples we discussed included the Main ORs calling for patients too early, the poaching of surgical kits, and surgeons creating overambitious operating lists that were bound to overrun and compromise flow. Similarly, inpatient service units at times transferred patients to the Main ORs even when said patients weren't ready (e.g. patient not consented; exam results pending; etc).

From an Information EA View three dominant characteristics emerged from the Main ORs data, namely the prevalence of paper-based information systems, the nonexistent electronic workflow information system, and poor data quality. Overall, Hospital ABC's electronic information systems capability was very limited and required extensive use of alternative modes of information sharing that not only were error prone and introduced system delays, but also required extensive human resource dedication and ultimately demanded more of them both physically and mentally.

From a Service EA View four dominant characteristics emerged from the Main ORs data, namely poor information flow and timeliness, compromised flow stability, compromised patient experience, and poor service architecture awareness/appreciation. These characteristics are largely a reflection of those of other EA Views. For instance, the poor service architecture awareness is similar to the construct we introduced in Chapter 6 (see section 6.5.2) whereby stakeholders make decisions while only mindful of their local context. Hence, a negative local process optimization behavior is a reflection of a stakeholder's poor service architecture awareness, as (s)he is negatively and independently impacting others upstream and/or downstream. However, other stakeholders may knowingly do so as they are under pressure and attempt to find a quick solution to their local problem, which in their mind is more important than those of others. Specifically, not only the local problem might not necessarily be more important than the problems that a quick solution introduces elsewhere in the service architecture, but also it isn't the recommended approach as a better solution might be available when considering two or more service units at the same time.

From a Knowledge EA View two dominant characteristics emerged from the Main ORs data, namely the limited access to stored information, and the poor organizational learning and limited medical training opportunities. These characteristics specifically result from the interactions across EA Views and are discussed below.

In examining each of the above EA View descriptions it is apparent that several EA View interactions are taking place. The following are some examples:

- The NHS 18 Weeks pressure (i.e. External / Policy View) drove senior leadership to set it as a core strategic objective (i.e. Strategy View), and given their poor understanding of hospital enterprise architecture, their pressuring of the Main ORs as the primary source of the problem reflected Hospital ABC's "us vs. them" culture and further contributed to the Main ORs stressed climate (i.e. Organization View).
- The preceding example reflected the ongoing pressures to increase throughput. In turn these pressures lessened the opportunity for medical training and organizational learning (i.e. Knowledge View) given that everyone was focused in squeezing yet another patient through the Main ORs.
- The need to reshuffle an operating list at the last minute (i.e. Process View) adds to the existing stressed Main ORs climate (i.e. Organization View) and ultimately potentially contributes to both the compromised patient flow stability and patient experience (i.e. Service View).
- The arms length relationship between clinicians and senior leadership (i.e. Organization View) was said to contribute to the lack of clinician access to financial related data (i.e. Knowledge View) which ultimately reflected a non-holistic measurement of Main ORs performance (i.e. Process View). Notably, the inherent limitations of Hospital ABC's information architecture capability, were also related to the lack of information access and data tracking (i.e. Information View).
- The predominant paper-based information systems across service units (i.e. Information View) together with the prevalent misaligned schedules across service units (i.e. Process View) not only contributed to the frustration and additional stress in the Main ORs (i.e. Organization View) but also to the poor information flow transparency (i.e. Service View) which ultimately further reinforced local optimization behaviors (i.e. Process View) and potentially compromised patient flow stability and patient experience (i.e. Service View).

All in all, our enriched understanding of Hospital ABC's enterprise architecture, and in particular that of its Main OR's sub-architecture, led us to determine that the service

unit's throughput issues neither resided only at a process level nor only within its boundaries. As such, investments and/or improvement plans solely targeted at the Main ORs would at best increase local efficiency and continue to deliver unsatisfactory results overall.

Presumably, if one were to holistically address the issues raised in our detailed characterization of each EA View, and doing so whilst supported by lean enterprise principles, one would be able to make decisions that would improve hospital performance. Next we continue to examine another embedded unit of analysis, namely the Administrative Support Services, so as to build a more complete characterization of the Main ORs and that of Hospital ABC as a whole.

8.5 Administrative Support Services

Administrative Support Services include stakeholders that either support Hospital ABC as a whole (e.g. process improvement engineers) or a set of service units. In both categories data collection consisted primarily of interviews but also included internal documentation and observation. A total of five interviews were conducted with Administrative Support Services and allowed for audio recording[168]. All interviewees were theoretically sampled[169] as per phenomena which emerged from the data while analyzing Hospital ABC's service units. Specifically, the sample included the director of the Surgery and Critical Care (SCC) division, the Main ORs Coordinator, the Anesthetic Delivery Manager, the director of Hospital ABC's internal Lean Team, and finally a maxillofacial surgeon responsible for Hospital ABC's OR interdepartmental management board. Each of the interviews took place in the respective offices of each of the interviewees. Additionally, observational data from non-participatory meetings was included, namely the OR Management Board (ORMB) meeting, and the OR Inpatient Service Unit Group (ORISG) meeting.

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[168] The Chapter's main text will include key interview excerpts to support the findings from the analysis. For additional excerpts please refer to Appendix V(i.b)

[169] Theoretical sampling is a technique used in strengthening in-depth case studies. Succinctly, theoretical considerations guide decisions about sampling and variables to include in a study. For a more detailed description please refer back to section 5.2.4.1

Figure 8-5is an overview of our characterization of Hospital ABC's sub-architecture beyond the Main ORs, as it emerged from the Administrative Support Services data analysis which concerns not only the Main ORs, but also other OR groups, as well as Hospital ABC in general (e.g. the internal Lean Team supported not only elective surgery sites but also the emergency department, and the ancillary service, and the clinics). As before, the characterization reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[170]). Similarly, the circle placement of the EA Views is meant to illustrate that they are interconnected but not necessarily how they are connected.[171]. The data analysis pertaining to this sub-architecture is presented in the next subsections.

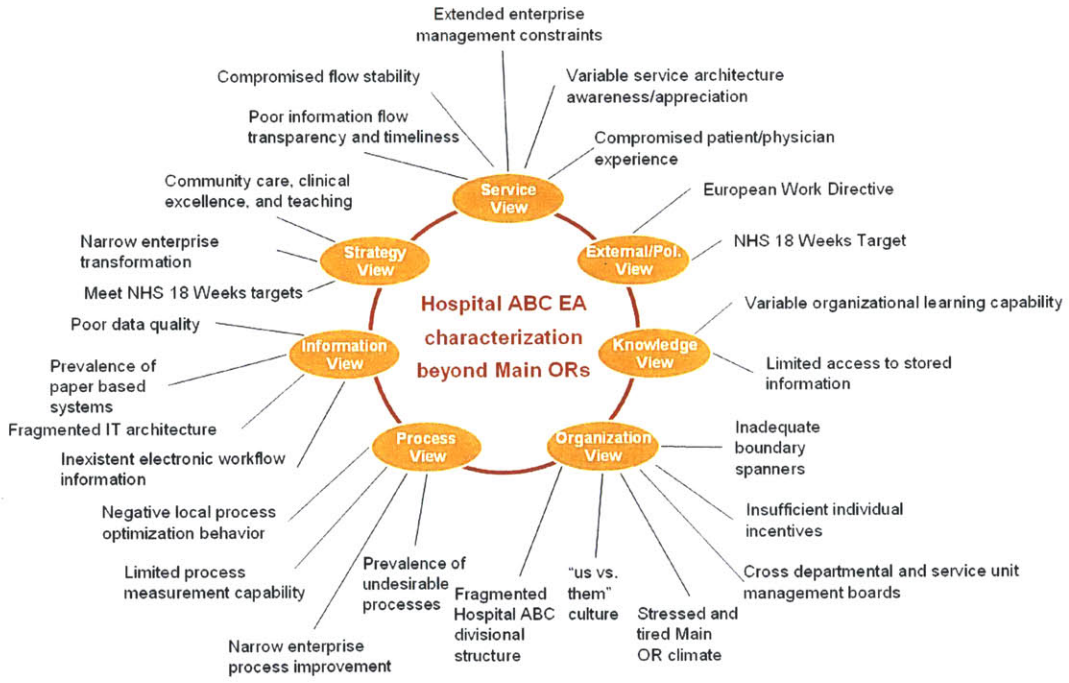

Figure 8-5: Hospital ABC Enterprise Architecture characterization beyond its Main ORs[172]

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[170] See section 7.7.2.

[171] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 8.5.8 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions.

[172] In section 8.5.8 we compare and contrast this section's sub-architecture characterization with the one previously discussed in the context of the Main ORs. In our comparison we leverage the use of data visualization techniques to help the reader readily identify key similarities and differences across the sub-architectures.

8.5.1 Administrative Support Services External / Policy View

The following summarizes the key aspects consistently referred by the interviewees pertaining to their external and policy environment:

- The European Work Directive had drastically reduced the amount of hours that junior doctors could work. This had an immediate impact on the quality of their training, as well as their availability to support Hospital ABC's operations, whether in inpatient service units, ORs, and elsewhere. Specifically, recently appointed full consultants (i.e. physician attendings) were running into trouble due to lack of experience (i.e. with fewer allowable work hours, junior doctors didn't train as much as they used to), and were being suspended immediately after completing training.
- The NHS' 18 Weeks target was placing significant pressure on Hospital ABC's operations. At the same time, interviewees were concerned with patient experience, which had become a *buzzword* in a recent NHS report[173].

"Under patient's choice if you are the only hospital that has missed 18 weeks, where do you think referrals are going to go?"

Hospital ABC SCC Division Director

"18 weeks has been a big forcing feature... we are clearly understanding it in a way we didn't before about the fact that we haven't got enough capacity to do the work that we have got to do and therefore we have got to be more efficient in order to sustain our position... and I think that is the big strategic change."

Hospital ABC Lean Team Director

8.5.2 Administrative Support Services Strategy View

Interviewees were consistent in describing Hospital ABC's triple mission as described already for the Main ORs (see section 8.4.2.2). Succinctly, these were providing high quality care to the surrounding community, pursuing clinical excellence with national and

[173] The NHS report is commonly referred to as "The Darzi Report" which was led by a British Lord named Darzi and where recommendations were made for the NHS to improve its quality of care Darzi (2008). High quality care for all: NHS Next Stage Review final report. NHS. London, Crown of United Kingdom.

international recognition, and sustaining its leading training programs. In general, interviewees described the existence of strategic tension in terms of the requirements of the different patient populations. On one hand, different specialties attract patients with different complexity which in turn requires different amounts of resources to treat. On the other hand, less acute patients will centralize in one set of specialties, whereas more acute patients centralize on another. The following quote is illustrative of this concern:

> *"I think it is a fantastic tertiary but local service focused hospital. It is really embedded in our population. We lose that at our peril as we might seek other sort of reputation in the national or international scene."*
>
> Hospital ABC SCC Division Director

The chairman of the ORMB criticized senior leadership's approach to enterprise transformation, in that it was difficult to convince them to make investments at various points of patient flow, rather than on the visible problem areas. As an example he described the focus on the ORs, and how leadership was considering adding an additional OR for Neurosciences, and yet, what was most urgently needed was additional resources at the pre-assessment phase[174].

8.5.3 Administrative Support Services Service View

Interviewees were consistent in describing delays and cancellations taking place in the Main ORs, and to that effect offered several reasons as to why they thought it was happening. Notably, they also shared that part of the reason that they were now aware of these issues, was because they had recently instituted the practice of cross service unit

[174] The pre-assessment phase takes place before a patient is admitted to Hospital ABC to undergo a scheduled procedure. A common problem that Neurosciences are struggling with, is that the waiting lists are large, thus the time elapsed between pre-assessment and procedure is large and allows for symptom changes (not to mention extended patient discomfort). The end result is that pre-assessments are no longer valid at the time of the procedure, and patient procedures need to be cancelled and rescheduled. Additional anesthesiologists to allow for a closer pre-assessment screening would help reduce procedure cancellations at the last minute (i.e. prevent inducing additional variability and stress on the Neuro ORs). Moreover, the ORMB chairman's inability to sway senior leadership's investment strategy is one example of their inadequate enterprise transformation scope.

management boards[175]. For instance, the chairman of the ORMB noted that surgeons needed to realize that what happens inside the OR is only a subset of the patient experience, and that if Hospital ABC is to improve its performance, they must necessarily acquire a sense beyond the OR (i.e. attain service architecture awareness):

> *"a lot of surgeons see it as 'end theatre... I am out of here'. [...] It would be rather fool hardly to ignore all of the aspects that come to leading to a successful completion of treatment, because me spending two hours with somebody in an operating theatre is only a small aspect of the time that has gone in to getting that patient in and out of [the] hospital appropriately"*
>
> Hospital ABC ORMB Chairman

The following are key themes that emerged as issues from the data[176]:

- **Poor coordination between the ORs and the inpatient service units.** Patients aren't being prepared in a timely manner and such delays the OR start times, sometimes causing cancellations, and ultimately contributing to overrunning operating lists. However, inpatient service unit nurses are starting their shift at the same time, or close to, the OR start times, hence they are busy doing patient handoffs and treating ill patients. Also, nursing staff in the inpatient service units might not be available to accompany the patient during transfer between service units. Additionally, it may be that porters aren't available to help push patient beds between service units.
- **Poor communication between surgeons and management.** Surgeons fail to update the centralized procedure schedule and hold on to their assigned OR slots until it is too late to find another patient to take a cancelled slot. Moreover, the Main ORs Coordinator isn't warned that a change has occurred in a surgeon's schedule, hence the OR slot scheduling remains unchanged, and ultimately goes

[175] Cross service unit management boards are discussed in detail in section 8.5.5

[176] The analysis of multiple embedded units of analysis allowed for the strengthening of the validity of our findings. For instance, several of the key themes highlighted here, as well as elsewhere in the remainder of this section, were already discussed in the context of the Main ORs. As previously noted, in section 8.5.8 we specifically conduct a compare and contrast analysis between the Administrative Support Services and the Main ORs. A similar comparative analysis is done with the remaining embedded units of analysis included in this in-depth case study.

unused. Alternatively, a surgeon may rearrange who is assigned to a given slot, and also leaves to the last minute until the Main ORs Coordinator is warned, therefore contributing to delays of last minute scrambling (e.g. preparing surgical kit for a different procedure; gathering the equipment necessary for a different procedure).

- **Poor communication between clinical staff within the ORs.** The OR staff fail to call the Holding Bay for the next patient. The Holding Bay nurse fails to call the inpatient service unit for the next patient. Etc.
- **Patient pre-assessments misaligned with actual procedure date.** The time elapsed between patient pre-assessment and the day of the procedure is too long, which may give rise to a patient's symptoms changing, which only becomes known at the last minute, and thus may force a cancellation.
- **Less common factors contributing to OR delays and cancellations.** Surgeons arriving late to the ORs and delaying the operating lists as a result. Equipment shortage due to 3rd party sterilizer not making instruments available on time. Unforeseen complications during a patient's procedure. However, these were neither considered to happen often nor to contribute the most to the overrunning operating lists.

The following quote particularly captures how the Main ORs feel pressured by stakeholders beyond their service boundary and that there isn't a shared service architecture awareness:

> *"We see ourselves as the piggy in the middle. The patients come from the wards to us, and they go from us to the wards. Many of our issues result from the ward not preparing...[...] The start of lists... if we start well it goes well... if not it is a snow ball effect that we always have to play catch up [...]They [namely, senior leadership] see that theaters are the fault on many occasions, but it is such a shame that they don't understand the big picture of it.."*
>
> Hospital ABC Main ORs Coordinator

Furthermore, the intervention of multiple stakeholders across the service architecture is such that information can be changed by different people. However, said information isn't centralized or readily shared across the service architecture, therefore exacerbating the above mentioned communication and coordination issues.

> *"Information should be made accessible easily for all the decision making stakeholders, and whenever a change takes place, instead of the information going back to only one stakeholder, it should be made available to all the stakeholders affected by that change. Ensuring that the flow of the information and the information are there as a resource."*
>
> Hospital ABC Anesthetic Delivery Manager

All interviewees were consistent in identifying the Cardiac ORs as the highest performing ORs in Hospital ABC. Conversely, the Neuro ORs were identified as the least performing. Finally the Main ORs were considered to be at the middle of the performance spectrum as compared to Cardiac and Neuro. Notably, the interviewee's perceptual assessment of the various types of OR's not only was consistent amongst interviewees but also with the performance scorecard shared by senior leadership[177]. Table 8-1 has an overview of Hospital ABC's OR performance for each of the respective service units. Each service unit is assessed in terms of four performance dimensions and can score either positively (+) or negatively (-). By inspection, the Cardiac ORs outperform all other service units in all performance dimensions, whereas Neuro ORs is the reverse scenario (apart from staff availability where the Main ORs score as poorly as the Neuro ORs). As for cancellation rates, the Cardiac ORs have less than 2%, the Main ORs have 9%, and the Neuro ORs have 18%[178].

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[177] For an overview of Hospital ABC's Performance Scorecard please refer to Appendix V(ii).

[178] Procedure cancellation rates were provided by the Surgery and Critical Care division director, and later confirmed with stakeholders from each service units. The rate itself pertains to the NHS operating lists which function from Monday to Friday. On Saturdays, Hospital ABC, as with any other NHS Trust, is allowed to sell its OR space and staff to private insurance companies who arrange for NHS surgeons to perform the procedures. Notably, the impact of Saturday operations is contained as private patients are located in a completely separate private wing of Hospital ABC. As such, Hospital ABC doesn't track the performance of these Saturday lists and doesn't consider them to be a core part of its operations.

Table 8-1: Hospital ABC OR Performance Overview

Performance Dimension	Main ORs		Neuro ORs		Cardiac ORs	
	+	-	+	-	+	-
Quality of Care	1	4	0	5	4	1
Patient Experience	4	3	1	6	7	0
Finance and Operations	5	9	3	11	11	3
Staff Availability	0	1	0	1	1	0
Total	10	17	4	23	23	4

Furthermore, lead clinicians from the Cardiac ORs were considered to be more proactive in terms of adopting a service architecture approach to improvement initiatives.

> *"Cardiac came out with the fact that this is how they wanted to run the surgery 'I want three cases in the day'. Anesthesiologists say 'you can't do that'. Okay sit in a room and tell us how you might do it and what are the resource implications for that together with your business manager, and then came back to us and say 'actually we need an extra recovery bed... we need the theater team to work over lunch time if we can actually start anesthetizing the second cardiac case as the other one is still coming off the table'"*
>
> Hospital ABC ORMB Chairman

8.5.4 Administrative Support Services Process View

Interviewees discussed at length their enterprise process improvement and planning practices. The following are key observations that emerged from the data:

- **Lean improvements failed to *stick* because of local optimized behaviors.** While the internal lean team was involved and onsite they were able to change some local processes. However, after the lean team had left, the care givers would revert back to their original way of doing things. For instance, since some operating rooms shared an induction room, it was recommended that a simple case start before a hard case. Such would allow for the simpler induction to be done faster, move the patient to the OR, and then bring in the other complex patient. However, both surgeons and anesthesiologists returned to their old practice of starting an induction depending on whoever got there first, as opposed to what made sense.

- **Lean improvements solely targeted at process level.** The SCC director felt that both senior leadership and the internal lean team were mistaken in their approach to improvement. Specifically, he didn't support their perspective that everything could be improved provided that the right processes were in place. Instead, he suggested that processes are simply a means to an end and that one should have the flexibility to institute incentives to change behaviors.
- **Lean improvement targeted at isolated service units.** Several improvement initiatives were described taking place at different service units. However, these efforts further reinforced the existing organizational fragmentation in that they optimized their existing structure, rather than consider a value stream improvement across the different service units. The Lean Team director expressed his frustration as to how simpler lean methods had proven successful (e.g. 5S and visual management) while scheduling "*never got off the ground*".
- **Lean improvements lacked strategic direction and failed to engage stakeholders.** The Lean Team director shared that earlier attempts at improving the enterprise had failed mainly for a lack of communication and strategic direction. The following quote captures his self-assessment:

  "So basically what we did was that we crashed landed... with no prior warning... with no engagement up front... with no strategic direction and just said that we have got to get in there and start doing stuff... and guess what... the management team didn't really buy it...the general manager never really got it and didn't buy it, she was being done too."

  Hospital ABC Lean Team Director

Interviewees also provided insight into their performance measurement capability, emphasizing the limitations of their existing information systems, and how they had to rely on guesstimates to inform their decision making, as well as assign a physical person to keep track of procedure cancellation rates and reasons for their cancellation. For instance, the information system installed in the Main ORs wasn't even able to indicate the top ten procedures per surgeon, and much less how long those procedures had taken on average.

Interviewees elaborated on their difficulties in managing the care delivery platform due to non-standardized processes and stakeholders exhibiting local process optimization behaviors without informing or considering other stakeholders beyond or even within their own service unit. The following are examples the interviewees provided in this regard:

- **Unclear role definitions.** Both nursing and physician/surgeon staff were said to be unclear at times as to who was responsible for a particular process. Moreover, people might have even been aware that a process needed to happen but they thought that it was someone else's responsibility to trigger and monitor it. Similarly, there wasn't a clear role description in terms of who was meant to educate others about processes in the Main ORs. Hence, there was a self-perpetuating cycle of unclear role definitions.
- **Each surgeon has his own list scheduling requirements.** Each division has its own admissions team in order to manage the initial scheduling of patient lists. Additionally, each admission team has to keep track of the individual preferences of each surgeon, and the efficiency of the scheduling depends on the quality of the relationship between the surgeon and the admissions team.
- **Surgeons elect to continue using paper-based operating lists.** Although the capability exists in the ORs information system for surgeons to schedule their procedures, the majority of surgeons elects to continue to use a paper-based system which is prone to generate miscommunication and inefficiency (e.g. junior doctors going back and forth pushing paper; operating lists having inaccurate data).
- **Surgeons schedule overambitious lists.** Some surgeons in the Main ORs consistently schedule overambitious lists which invariably overrun and place a strain on the overall patient flow. Interestingly, the Main ORs Coordinator shared that there is indeed a senior surgeon that checks the operating lists every day, but he fails to dissuade the offending overambitious colleagues.
- **Junior doctors purposefully insert wrong information to secure an OR.** When a patient is added to the operating list as a last minute patient, junior doctors are required to fill out a standard form where they indicate that they have ordered the

necessary tests, that the patient is consented, etc, otherwise the junior doctor isn't allowed to schedule the procedure. As a result junior doctors often insert wrong information, and perhaps under the assumption that everything will be ready in time for the procedure. However, their localized optimization contributes to throughput issues later on when they realize that a procedure cannot start because something is missing.

"They [junior docs] genuinely believe that they can get the tests in time for the blood work, or imaging, etc but then someone else has let down the system and the things are not ready as expected. There are so many variables and all of them are relying on everyone playing the game."

Hospital ABC Main ORs Coordinator

- **Holding bay nurses insisting on using porters to transfer patients.** Management had set a policy that patients fit to walk from an inpatient service unit should do so whilst accompanied by an inpatient nurse. Instead, the holding bay nurses are said to insist on using porters to transfer patients, as they believe that patients shouldn't be made to walk just before a procedure (and even though said patients checked into Hospital ABC the day before and were perfectly mobile).
- **Surgeons failing to communicate changes that they made to their operating lists.** Main ORs staff find themselves preparing the wrong surgical kits because they printed an operating list from the system, and it no longer is accurate because a surgeon changed something on the list (e.g. decided to operate on another patient when rounding on the inpatient service unit) and failed to update the information on the system. Similarly, the admissions team will not know of the change being made and may schedule a procedure on an OR slot that was thought to be available, when in fact the surgeon already agreed with a patient to conduct a procedure in that slot. Additionally, surgeons may fail to warn the Main ORs Coordinator that they aren't planning to use one of their designated OR slots, hence, more often than not contributing to unused OR capacity. Conversely, some surgeons who were on leave of absence may decide to come to Hospital ABC

without warning the Main ORs Coordinator and force a last minute scramble in order to find capacity and ready the ORs for him.

"It all depends on the relationship between the surgeon and the admissions team are having. And they all work differently. And you would hope there is always a very open communication channel but you don't know where all the information is held"

Hospital ABC Anesthetic Delivery Manager

Finally, interviewees referred that scheduling in general was a complex task which required considerable human intervention and was prone to inefficiency mainly because of the fragmented division structure, the local optimization behaviors previously mentioned, and the fragmented information systems supporting each stakeholder. For instance, the Main ORs scheduling system is based on an excel sheet which used a coloring system that needs to be updated manually by the Main ORs Coordinator, and isn't integrated to any other system. Concurrently, the Anesthetic Delivery Manager has her own set of systems (i.e. excel, paper, and proprietary software) in order to keep track of annual leaves and general availability of anesthesiologists, so as to staff an OR procedure. As a result, both the Main ORs Coordinator and the Anesthetic Delivery Manager have to go back and forth bridging across their different systems, as well as those of others (e.g. admissions), in order to arrive at a scheduling decision.

"Just the logistics of producing roster, ensuring they know where they are, managing annual leave systems, managing sickness, supporting the clinical director in the management of the consultants and the junior doctors, ensuring that the right people are at the right place at the right time. It is like ***throwing a lot of balls up*** *in the air and making sure that they get into the right slots."*

Hospital ABC Anesthetic Delivery Manager

8.5.5 Administrative Support Services Organization View

Hospital ABC had a fragmented divisional structure and experienced a considerable organizational divide amongst senior leadership, management, and clinicians

Interviewees provided further evidence concerning Hospital ABC's stakeholder divide

among senior leadership, management, and clinicians. The following are the key themes that emerged from the data:

- **Fragmented division structure**. Management recognized that they struggled with assets belonging to a particular division and staff members belonging to another division. Specifically, the SCC managed the ORs and the anesthesiologists that serviced all the other divisions (e.g. Cardiac and Neurosciences, Liver, etc). However, the surgeons of each division were said to have an allegiance to their respective division, which in turn hindered the value alignment across divisions. For instance, SCC centrally managed anesthesiologists in order to identify potential crossovers in staffing ORs. However, each division was continuously trying to become ever more independent and manage its own anesthesiologists for instance.

  "Everybody works in silos... is that because you have direct relationship between the surgeons and their admissions... they tend to stick very close to their offices... they don't have to have a phone conversation with someone on the other end of the hospital. Those silos foster the relationships between them."

  Hospital ABC Anesthesiologist Delivery Manager

- **Cooperation between middle management and junior clinicians.** The middle organizational layer at Hospital ABC was more often than not tasked with making sure that information flowed and that the enterprise delivered its value proposition. Recognizing inherent limitations in the hospital's enterprise architecture (e.g. lack of an electronic medical record; fragmented divisional structures) both middle manager and junior clinicians[179] felt that they were working towards a common goal and had mutual respect.
- **Some cooperation between senior management and senior clinicians.** The SCC division director was proud of what he called "*the embarrassment strategy*" where he would publically and promptly publish data concerning individual

[179] It is important to note that a junior clinician at Hospital ABC, or in the NHS system in general, is any physician who isn't yet an attending (i.e. a physician/surgeon consultant in the UK). However, the UK's medical training is such that it generally implies that the junior physicians are in their late thirties when they reach attending level (note: in the US it can be as early as their late twenties). Moreover, the designation "junior clinician" doesn't necessarily convey the maturity that some of the physicians already have.

surgeons. He was particularly fond of the OR late starts metric, however such metric doesn't explain why an OR was late (i.e. late starts were often related to issues that lay beyond the Main ORs), and when used in this manner, it is representative of the tension between the two groups. Additionally, the director described that surgeons would delay their operating lists on purpose, so that Hospital ABC was forced into paying them additionally to operate on Saturdays and meet the NHS 18 Weeks target. However, it was also noted that different surgeons appreciate different division director styles, and the individual style may set a fundamentally different tone as to how the tension and cooperation takes place between management and senior clinicians.

- **Some cooperation among management and senior clinicians.** The OR Management Board (ORMB) was an interdepartmental board to bring together senior clinicians from all divisions at Hospital ABC and openly discuss ongoing issues (e.g. waiting lists; cancellations). The ORMB was presided over by a surgeon well recognized amongst his peers, and who relied on empathy in order to attain the buy-in of other surgeons to change their behaviors and processes. Moreover, the ORMB relied on voluntary attendance and on the empathy of its chairman in changing his peers. Additionally, the Main ORs Coordinator was also present at the ORMB. However, her role was limited to observation and reading a long list of metrics (e.g. cancellations; late starts). The coordinator later explained that she didn't feel at ease to confront senior surgeons on the Main ORs issues and that on her day-to-day business she felt powerless to force surgeons to finish overrunning lists which were clearly a result of their own actions (e.g. late arrival; overambitious list).
- **Cooperation between middle management and nursing in general.** Similar to the ORMB, Hospital ABC had recently begun an interdepartmental board to bring together the nursing staff from the ORs and inpatient service units. The board was called OR Inpatient Service Unit Group (i.e. ORISG) and was presided over by a middle manager. From observation, as well as interviews, it was visible that nursing staff openly discussed their issues in their individual service units, and tried to explain why their interaction with other service units wasn't as good as it

could be. The nature of the solutions that were pursued tended to be narrow (e.g. focused on improving one specific process rather than considering the service units as a whole), however the ORISG was nonetheless evidence that a communication platform was being developed amongst nursing staff and that they were vested in improving their overall performance.

- **Tension between management and senior leadership.** Management characterized senior leadership as being primarily interested in the "*big glamorous services*" and in doing so forgot about the common local patient. As a result, Hospital ABC's service architecture had difficulty in accommodating the different types of patients (i.e. specialized care vs. regular care). Additionally, management felt unsupported by senior leadership to execute necessary unpopular initiatives in order to meet the NHS 18 Weeks target. Specifically, the SCC director described senior leadership as theoretical in its discussions with clinicians, and failed to emphasize the strategic importance of a particular change, and harbor the support of everyone towards that change.
- **Tension between senior leadership and clinicians.** As previously noted, the chairman of the ORMB was a surgeon leader. In characterizing senior leadership's attitude towards meeting the NHS 18 Weeks target, he said that they simply expected the existing delivery platform to work harder and refrained from investing on additional staff or compensating them for the extra hours (i.e. *"they are doing it on the cheap at the moment*").

"Sometimes what can happen at a place like [Hospital ABC] at the strategic level is that the discussion is all about, you know, the big glamorous services, the ones that have a national or international reputation, like liver, cardiac, neurosurgery, oncology. Forgetting the fact that the experience of most local patients is far more likely to be in our chest clinic, or in orthopedics, far more people locally experience those services."

Hospital ABC SCC Division Director

<u>Hospital ABC had valuable cross service unit management boards but they lacked senior leadership support</u>

The issue of division compartmentalization was known to both management and

clinicians. Learning from the practices of the Cardiac ORs[180] which were said to contribute to its higher performance, two management boards (i.e. ORMB and ORISG) had recently been instituted by the director of SCC. Essentially, the boards were meant to provide a forum where clinicians and management, from different service units, could openly discuss issues (e.g. late OR starts; number of OR cancellations; etc) and attempt to arrive at solutions to address them. Additionally, they contributed towards transparency and consequently a sense of accountability, as surgeons didn't appreciate having their peers publically think poorly of their dedication and performance.

In doing so, the boards would avoid going back and forth between management structures and hold independent discussions. Instead, issues would first be identified at the management board level and subsequently assigned to a subset team who would include all necessary stakeholders (e.g. anesthesiologist, surgeons, nurses, etc), derive a solution, and propose it back to the management board. Furthermore, the boards would serve as a mechanism to shape a culture towards improvement and accountability. As previously noted, the issues pertained to the interaction between different service units. Theoretically, the management boards made great sense and indeed replicated proven methods from the Cardiac ORs. However, execution limitations were hindering their usefulness.

One of the groups (i.e. ORISG) was devised specifically for nursing staff from the inpatient service units and ORs. The other group was devised for senior clinicians from the ORs (i.e. ORMB). Whereas the ORISG was in the process of developing a cohesive group with a shared mission to improve, the ORMB was struggling with engaging and motivating all senior clinicians to change their behaviors and contribute with solutions. Specifically, the chairman of the ORMB felt that the board needed the involvement of senior leadership in order to establish its strategic imperative and get the required buy-in from senior clinicians in general. Notably, the director of the SCC division had expressed a similar sentiment about senior leadership not supporting his efforts in engaging senior clinicians with necessary unpopular initiatives.

[180] Discussed in detail in section 8.6.1

"I think that the theatre management is coming... I can't go around and wag the finger at somebody... This is all done by encouragement... by trying to understand people... and empathy... and trying to get people to say "guys we need to do this better, and actually if you play ball, maybe the management will look at these issues, they may well look at how we can improve the moral in terms of incentives and reward etc".[...] this is where the Theatre Management Board lacks in my view a senior manager allocated to it. In other words, [the CEO], or someone along those lines because she also needs to hear what are the sticking points. At the moment I don't have a regular meeting with [the CEO] on the back of this."

Hospital ABC ORMB Chairman

"I have had the director of operations and the chief executive come to me into the surgical teams, where I was hoping, that in not a blunt way, but in a pretty reasonable straightforward way they would make the strategic imperative and the consequences of failure clear. Yeah?! They didn't! They had a nice theoretical conversation and left it with me. Quite frankly I am pissed off about it. But it is just one of those things [where] as a middle manager you are a bit [like] the meat in the sandwich."

Hospital ABC SCC Division Director

External pressure hindered service unit performance reviews

Performance reviews are currently in place at Hospital ABC on a monthly basis. Management recognizes that these are insufficient in order to keep close monitoring of operations and make necessary adjustments. However, they also cite that the pressure to meet the NHS's 18 Weeks is such that they are unable to afford additional time to track and review performance. Moreover, management and clinicians are kept working flat out and aren't able to collect, review, and make decisions on data on a more regular basis.

External pressure increased tension between management and specific service units

Management recognized that the external pressure of the NHS' 18 Weeks target was triggering issues and tension between the leadership of neurosurgery and the SCC division, as they were struggling to keep up with the demand given their existing OR throughput and availability.

Administrative Support Services regarded NHS' salary structure and labor laws as inadequate, and that these constrained its ability to adequately reward or punish clinicians according to their effort

Management felt that Hospital ABC had to be able to provide clinicians with a good environment to work in, so as to attract the best surgeons and further support the hospital's mission. However, management also emphasized that they need to closely monitor clinicians in order to ensure that they are managing their waitlists and not incurring unnecessary additional costs for the hospital. Specifically, both surgeons and nurses were said to delay their operating lists in order to force the use of Saturday lists whereby Hospital ABC had to pay surgeons per procedure. Finally, management observed that they didn't have the flexibility to financially reward staff on merit, hence they were prone to induce the wrong behavior or reward people who didn't deserve it.

> *"In the public sector the whole issue of incentives is a massive issue. How do you design something for the knaves that does not compromise the knights?[...] I think there is a lot of stuff that goes on at the subconscious level like 'hang on a minute, lets not get this patient quite as quick as we need, lets have a break' [...]At the moment we are relying on a massive amount of discretionary effort which is not rewarded and therefore it is hugely variable. People say what the hell do I get for being more productive? On the carrot side I feel constrained. The way the system is setup is that you end up having to give the bonus to everyone even if they haven't performed."*
>
> Hospital ABC SCC Division Director

> *"To incentivize some of these individuals you have to be very careful. They are easy to string a list out, to take more time just to get the overtime at the end because you know you are going to get it."*
>
> Hospital ABC ORMB Chairman

Constrained by NHS's salaried structure the SCC division director instituted the practice where any savings that individual service units were able to derive from their annual budget, would be theirs to invest in additional resources as they saw fit (e.g. equipment, training, staff, etc). Although the redistribution of surplus was viewed as a positive thing

by senior clinicians, the side effect was that it also reinforced the independent culture of each service unit. Moreover, their incentive was to optimize internally and not necessarily engage at their interfaces in order to derive greater improvements. Notably, some service units had already been engaging their interfaces (i.e. Cardiac ORs); however they were doing so out of their own initiative and not because of a strategic directive or a rewarding system that encouraged that behavior.

Management also made reference to their inability to financially penalize surgeons for their poor performance. Instead, any losses were sustained by each division's management structure, and no direct link existed with the surgeons themselves. However, surgeon interviewees also argued that they only had a salary structure, and were interested in a procedure volume based incentive in order to drive throughput.

Finally, the chairman of the ORMB observed that changing the hospital culture was going to take time and in some cases would require specific individuals to retire and then bring in new appointments. However, he also observed that mechanisms need to be in place in order to incentivize changing the status quo. For instance, if surgeons are requested to work longer hours, they should be given some sort of compensation at least in the form of additional equipment. Similarly, he argued that nursing staff should be given the option to have more flexible work arrangements where they could elect to work longer days and shorten their work week, or potentially take a longer holiday instead. Finally, he argued that people shouldn't be rewarded on the number of years that they have worked, but rather in their dedication to Hospital ABC and on their merit. Instead, clinicians are said lower ranked clinicians are said to leave Hospital ABC because they feel that they aren't appreciated and are blocked by more senior staff members.

> *"But it will happen... but [it] is a slow, slow, culture change... but the minute we can break that with the next round of appointments, hopefully, then you will start to see a seed change... and that is difficult"*
>
> Hospital ABC ORMB Chairman

> *"Pay them more. Give them an incentive. Say 'these are the cases, do you think honestly*

that we can get through 8 cases rather than 7 in this timeframe, if we pay you an incentive?' This is a dirty phrase within the NHS, okay, they don't like this. But for Christ sake this is what you do in any other aspects of business!"

Hospital ABC ORMB Chairman

Team familiarity was said to be conducive of higher OR performance

Anesthesiologists and surgeons are teamed together consistently and allocated to the same ORs as managers find that this arrangement is conducive of higher OR performance. Specifically, anesthesiologist and surgeon share an understanding of each others' regular practices and are familiar with a particular type of patient and associated procedure. Conversely, junior doctors have short rotations at the Main ORs and such is said to contribute to a continuous reset of the learning curve in terms of the new junior doctors and their relationships with management and the remaining staff.

The Main ORs Coordinator's skill set was considered inadequate by both interviewed clinicians and managers, and such negatively impacted her ability to manage operations

Previously when analyzing the Main ORs surgeon and anesthesiologist views of the Main ORs coordinator, we had already established that she was poorly characterized as a non-clinician who didn't have the required skill set and credibility to manage their OR operations. Similarly, within the management structure itself, there were negative views of the Main ORs Coordinator. The Lean Team director qualified her as an impediment to large scale lean improvements, whereas the ORMB chairman insisted that she was unable to visualize theater capacity and to flexibly allocate clinicians across different ORs (i.e. staff was assigned to a specific OR). However, the SCC division director also recognizes that managing clinicians can be very difficult and that sometimes he has to intervene in order to protect the Main ORs Coordinator.

"This might work for British Airways, this might work for Aerospace, and sure of course it is about process, but the people who give the messages have to have an intrinsic understanding and be recognized as being credible to those people they are giving the message to. [...] You need somebody with an overview of what is going on."

Hospital ABC ORMB Chairman

"I provide aerial cover for her. 'Right you get a load of grief for this, if they cross a line of where it is acceptable and where it is not acceptable then I will deal with it', and I have had to have a few anesthesiologists interestingly up here and said 'that was essentially bullying and don't do it again. You are not getting away with that even if you got away with it in the past'"

Hospital ABC SCC Division Director

Clinician accountability was achieved through data transparency, but some mechanisms were considered to be more adequate in changing clinician practices and behavior

The management layer at Hospital ABC proactively attempted to measure behaviors with concrete measures. In particular the SCC division director believed that culture was a soft term, that although important, was all too often "*thrown about*". For instance, managers began tracking late starts of operating lists, and believed that the publishing of that information had led surgeons to be more accountable. However, while interviewing clinicians it was apparent that they weren't pleased with how the information was shared at times, and hence it contributed to further entrenchment of the clinician vs. management culture. It wasn't that the information content was being questioned, rather the process of delivery was considered inadequate. Hence, the previously described and recently created cross service unit management boards were regarded as a valuable mechanism to not only address issues, but also do so in an appropriate manner.

8.5.6 Administrative Support Services Knowledge View

Whilst analyzing data collected from the Administrative Support Services, the following key themes emerged with regards to their Knowledge View:

Hospital ABC was trying to build an organizational learning capability

As previously noted, the practices of the Cardiac ORs in terms of solving both its own issues and attempting to improve their interactions with other service units, prompted management to create cross service unit management boards which were in their infancy at the time of data collection. However, the management of the boards was comprised of both clinicians and non-clinicians, and their espoused values and ideas were aligned with

those of an organizational learning organization. Specifically, they understood that service units don't operate in a vacuum and that surgeons shouldn't only concern themselves with what happens inside the OR, and instead should also concern themselves with the inpatient service units, as well as the pre-assessment clinics. Moreover, their observations and improvement plans were evidence of their service architecture awareness. As such, their improvement approach was one built on engagement and participatory decision making in the context of the management boards. The intent was to bring transparency to issues, as well as make senior clinicians feel accountable, and understand how their behaviors were affecting others downstream and upstream. Furthermore, the ORMB in particular, adopted concepts similar to those of lean enterprise thinking when they included multiple stakeholders from various groups, and essentially put together cross disciplinary teams to address problems in an expedited and consensus driven manner. However, both the SCC division director and the ORMB chairman were aware that they were merely at the infancy of their cultural transformation, and they were still trying to find ways to counter key obstacles to their efforts. To begin with, the existing pressure to meet the NHS' 18 Weeks target prevented them from holding more regular performance review meetings, let alone allocate resources to support improvement initiatives.

> *"One of the issues is that we have sweated the asset far more... the soft time that we used to have has evaporated because we are cracking through the work... the production line has got to be like buzzing all day long, seven days a week, or five days a week or whatever... so we have that challenge now as to how we release staff to do that sort of stuff..."*
>
> Hospital ABC SCC Division Director

Then, there were clinicians who were comfortable with the *status quo*, didn't want to change things, and if anything, wanted to further increase the fragmentation or at the very least revert back to the old way of doing things. Additionally, they felt that they didn't have the necessary reward mechanisms to motivate the right kinds of behaviors and to nurture a culture of meritocracy, rather than the traditional NHS "*cast system*". Also, they felt that senior leadership wasn't involved enough in their efforts, and that the boards

weren't regarded as a strategic imperative by several clinicians, even though they were a mechanism devised to replicate and magnify Cardiac ORs practices, and in doing so, address the pressure of the NHS' 18 Weeks. Finally, the boards relied mostly on opinions or lagging indicators such as the number of cancelled procedures, as the existing information systems capability was unable to capture more detailed information regarding patient flow. All in all, the Cardiac ORs had been repeatedly singled out as an example to replicate, and attempts were being made to apply their learning at a wider scale.

> *"I think it is good for [Hospital ABC]. By my very nature I like things when they work well. I hate waste, but I also want to make sure that people are reimbursed and feel part of something that they are adding to. It has got to be a team culture. It really has to be. And unfortunately there are several teams that are working in theatres at the moment and what you are looking for is something that is going to bring them all together. [...] There is a perception that there are things that keep popping up that are common to everyone. So that might mean that we need more recovery space across the board. It might be about how the pre admissions setup is designated for all the critical care about how they can get these patients into on day admissions. Reduce through anesthetic pre assessments the number of on day cancellations. Speed things up with some generic things that might need a bit of investment and actually someone with a bit of clout to say "I can see how this is going to improve it""*
>
> Hospital ABC ORMB Chairman

<u>The Main ORs (non-clinician) Coordinator was said to have an inadequate skill set, and such negatively impacted her ability to manage operations and assist other managers</u>

Several observations were made stating that the existing Main ORs Coordinator didn't have the necessary skill set and credibility in order to influence the necessary behaviors amongst clinicians, and also execute resources flexibly. Instead, resources were assigned to specific ORs, and it was common for an OR to go unused because she wasn't able to reassign staff, or to influence surgeons to take responsibility and finish a list that is overrunning because of non-clinically related issues (e.g. overambitious list; surgeon arrived late). Furthermore, the ORMB chairman felt that the Main ORs Coordinator

didn't provide him with the necessary information as to what was really happening on the ground.

8.5.7 Administrative Support Services Information View

The Administrative Support Services were in the process of deploying cross service unit management boards which helped improve information flow. However, such was done in ad-hoc manner and not on a day-to-day basis. As previously noted in the analysis of the Main ORs (see section 8.4.2.7), information was shared predominantly in paper format and physically (e.g. verbally over the phone or in the presence of another).

The scheduling of procedures was a complex process that required extensive human intervention from different service units, which had their own information systems that not only weren't integrated across service units, but also weren't integrated within each service unit.

For instance, the Anesthetic Delivery Manager had to manage staffing with no less than five separate systems. One was a paper-based ledger which kept staff holidays. Another was an off-the-shelf software specifically designed "*for the production and management of anaesthetic department rotas*"[181]. Another was the OR electronic information system, however the manager didn't quite trust the system because she knew that more often than not it was populated with outdated information. The fourth one was the daily email she received from the Main ORs Coordinator with the finalized operating list that needed staffing for the subsequent day. Finally, the fifth one was a weekly planning sheet of paper she created every Monday morning after meeting with the Main ORs Coordinator. The Main ORs Coordinator was faced with a similar situation and she used a series of excel sheets with her own coloring system to attempt to keep track of OR scheduling. For instance, all OR slots were pre-assigned to different surgeons, and she manually conciliated information with the admissions system in order to determine whether or not a surgeon had already booked a patient for his given slot. If she saw that a slot was yet to

[181] See http://www.rotastar.co.uk/

be booked she would physically chase the surgeon and ask him whether he intended to release the slot, and if she could use it for another procedure. However, this system was very error prone, as we previously observed that surgeons don't always inform admissions or indeed update the Main ORs information system with their operating list changes. Moreover, a slot might look empty but it isn't, hence the Main ORs Coordinator never really knows whether there is an opportunity to squeeze in another procedure.

Also, the ORMB chairman expressed difficulty at times in determining whether or not a colleague's list was overambitious as he wasn't aware of his colleague's historic performance for a particular procedure. Hence, even when decisions were thought to be overambitious, they were kept the same as there wasn't any readily available data to refute whoever suggested the list in the first place. Similarly, the activity of the ORMB could be better supported if information was available in terms of the patient throughput throughout the value stream inside Hospital ABC. Instead, they had to rely on anecdotal evidence set forth by different stakeholders belonging to different service units and hope to reach some consensus. Admittedly, the previously noted *status quo* surgeons proved to be more difficult to change, and it was thought that workflow information would be essential to nudge them towards indeed changing their behavior.

> *"the problem here with the theatres debate in general is that people regard their opinions as facts and we have to disabuse them where that is possible."*
>
> Hospital ABC Lean Team Director

Overall the Main ORs information system was considered unsuccessful at supporting the administrative services for several reasons. To begin with the system was unable to indicate what had been the top 10 procedures in a given time period, given that people inserted information in free-text boxes which were prone to generate different labels that prevented the aggregation of data (e.g. "right ear" vs. "RT ear"). Additionally, even though the system offered the capability for surgeons (or someone in their behalf) to insert the operating lists electronically, most of them preferred to continue to use paper, and instead give the lists to the Main ORs front desk and have them update the system the

day before the procedure. However, a particular surgeon might have already known ahead of time that he was going to introduce a change into his operating list. After all, if the patient wasn't already an inpatient, he or she would have had to have made arrangements to come to the hospital for the procedure. Instead, the information is shared on paper only the day before, and the Main ORs have to consistently make last minute adjustments in the preparation of surgical kits, staffing of anesthesiologists, etc.

> *"The technology currently supporting theatres is woeful and despite them introducing [the Main ORs information system]"*
>
> Hospital ABC ORMB Chairman

Finally, since different information systems aren't integrated, all sorts of inefficiencies may arise. We have already noted the issue of ORs going unused because surgeons didn't share their updated operating list in a timely fashion. Also, OR staff may find themselves preparing surgical kits for operating lists that are no longer in effect. Additionally, junior doctors wanting to make sure that they get their patient into an available OR slot, may be tempted to lie about whether or not a piece of information is indeed already available (e.g. the result of a lab test, or imaging, or patient consent, etc). Furthermore, junior doctors find themselves pushing paper and walking great distances from their senior surgeon's office to the Main ORs front desk in order to deliver/pick up paper-based operating lists.

All in all, Hospital ABC's electronic information systems capability was extremely limited and required extensive use of alternative modes of information sharing, that not only were error prone and introduced system delays, but also required extensive human resource dedication and ultimately demanded more of them both physically and mentally. Finally, the absence of accurate workflow information systems made the Main ORs further rely on tacit knowledge (or rather guesstimates) in terms of planning each day's operating list for each OR.

8.5.8 Administrative Support Services analysis summary

In this section we presented our analysis of the Administrative Support Services which not only concern the Main ORs, but also Hospital ABC as a whole. A total of five recorded interviews were conducted with both clinician and non-clinician management stakeholders. Specifically, these were the SCC Division Director, the Main ORs Coordinator, the Anesthetic Delivery Manager, the Hospital ABC's internal Lean Team Director, and finally the ORMB Chairman. Additionally, evidence included observation at non-participatory meetings of the ORMB and the ORISG interdepartmental management boards, as well as internal reports on service unit performance (i.e. Main ORs, Cardiac ORs, and Neuro ORs).

Overall, the analysis of the Administrative Support Services was consistent with the characterization of Hospital ABC's Main ORs sub-architecture, and established that several of its elements were replicated throughout the hospital enterprise. However, there were also other elements that emerged and that weren't replicated. The different elements emerged as the Administrative Support Services not only concerned the Main ORs, but also other OR groups (e.g. Cardiac ORs, Neuro ORs, etc) as well as Hospital ABC in general (e.g. the internal Lean Team supported not only elective surgery sites but also the emergency department, and the ancillary service, and the clinics; the ORMB and ORISG concerned not only elective surgery sites but also the inpatient service units; etc). As such, Figure 8-6 is the characterization presented earlier of Hospital ABC's enterprise architecture beyond its Main ORs[182]. The coloring of the elements in the figure is a visualization technique to readily compare this sub-architecture with that of the Main ORs previously discussed in section 8.4.3. Specifically, black denotes no change from the Main ORs sub-architecture; red denotes new elements; orange denotes previous elements which have changed in some regard. Furthermore, in the descriptions that follow we also directly make comparative references to the Main ORs sub-architecture[183].

[182] See section 8.5.
[183] For additional detail on each of the Main ORs elements referred to, please see section 8.4.3.

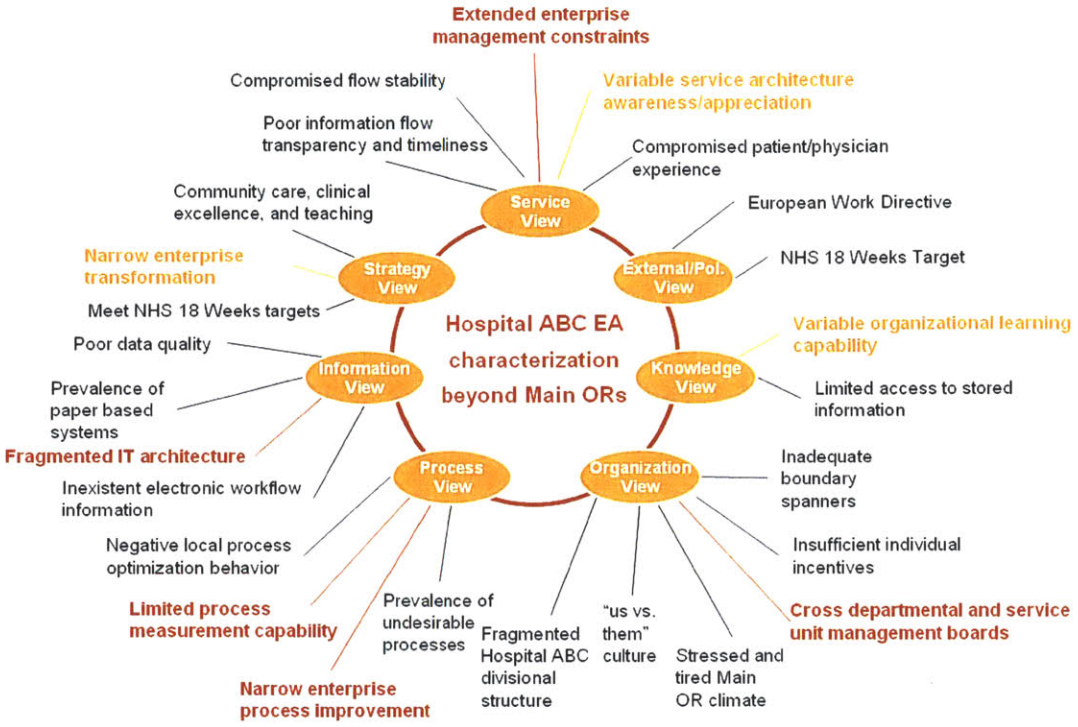

Figure 8-6: Hospital ABC Enterprise Architecture characterization beyond its Main ORs

The following summary analysis concerns the new elements (i.e. red in Figure 8-6) that were identified as compared to the Main ORs sub-architecture:

Extended enterprise management constraints: interviewees broadened the analysis of the Main ORs value stream beyond Hospital ABC's campus boundaries, as they correctly understood that they needed to somehow manage the extended enterprise, or at least be sensitive to its potential effects. On one hand, they described how patient pre-assessments were being made much too early which contributed to the likelihood of procedures being cancelled at the last minute, given that patients may have changed symptoms in their long wait. On the other hand, third party service providers responsible for equipment sterilization weren't being able to offer a service at the level that was required. Notably, the extended enterprise management constraints reinforced some of the previously characterized elements in the Service EA View, namely an increased likelihood of patient cancellation further compromised patient experience and patient flow stability.

Fragmented IT architecture: previously we had already established that Hospital ABC made extensive use of paper in its information systems. However, in broadening the analysis beyond the Main ORs we established that there was also fragmentation in their IT architecture. Specifically, different functions within the SCC division (i.e. Main ORs Coordinator and Anesthetic Delivery Manager) and across Hospital ABC (i.e. hospital admissions) used different IT systems. Some of these systems were off-the-shelf solutions, others had been internally developed by third party providers, and yet others were being independently maintained by their users (i.e. excel sheets). Notably, the IT architecture fragmentation reinforced some of the previously characterized elements in the IT EA View, namely the prevalence of paper-based systems, and the existence of poor data quality.

Limited process measurement capability: interviewees had to rely on *guesstimates* in order to evaluate and manage different parts of Hospital ABC's patient flow. Examples we discussed included the inability to assess automatically whether a surgeon's proposed operating list was indeed over ambitious given that particular surgeon's past performance, as well as an overarching inability to measure patient flow and identify problem areas within and beyond an individual service unit. Notably, the limited process measurement capability allowed for potential reinforcement of some of the previously characterized elements in the Process EA View, namely the existence of negative local process optimization behavior which remains visibly concealed, and the prevalence of undesirable processes such as the guesstimating we already mentioned.

Narrow enterprise process improvement: the Lean Team Director in particular, but also several of the other interviewees, gave evidence of a narrow enterprise process improvement approach. Examples we discussed included the use of specific lean tools (e.g. 5S) within specific service units, while end-to-end improvements such as operating list scheduling were never tackled. Notably, the narrow enterprise process improvement approach reinforced some of the previously characterized elements in the Process EA View, namely the existence of undesirable processes (i.e. improvements driving local efficiency and not tackling enterprise effectiveness) and negative local process

optimization behaviors (i.e. silo based improvements are unable to consider/assess value stream impacts of local processes).

Cross departmental and service unit management boards: two mechanisms had been recently instituted (i.e. ORMB and ORISG) to improve performance in the interaction of various service units. Specifically, the intent was to eliminate the back and forth between different management structures (i.e. address Hospital ABC's fragmented divisional structure), share information openly and appropriately (i.e. reverse the "us vs. them" culture), and implement solutions that improved performance across Hospital ABC's value streams, and ultimately reduced the stress in each service unit. Notably, the ORMB was led by a well respected surgeon but senior leadership wasn't as involved as felt necessary to attain senior clinician buy-in across Hospital ABC. ORISG exhibited a good working relationship amongst nursing staff from various service units, as well as with the middle management personnel attending those meetings. However, ORISG solutions tended to be targeted at a process level and to be simple in nature. Finally, two service units were consistently singled out as being better/worse performing, as measured perceptually and objectively by Hospital ABC's scorecard, namely the Cardiac ORs and the Neuro ORs.

The following summary analysis concerns the previous elements (i.e. orange in Figure 8-6) which have changed in some regard, as compared to the Main ORs sub-architecture:

Variable service architecture awareness/appreciation: previously we characterized the Main ORs as having poor service architecture awareness/appreciation. In examining the Administrative Support Services data we established that different stakeholders had different levels of service architecture awareness/appreciation. Examples we discussed include the ORMB Chairman's understanding that enterprise transformation and process improvement plans shouldn't only be focused at process level or within an individual service unit. Similarly, the Lean Team Director, although responsible for the narrow enterprise process improvements, recognized that his efforts had failed to address end-to-end processes. Hence, there was variable service architecture awareness/appreciation

when considering our characterization of the Main ORs and now that of the Administrative Support Services.

Narrow enterprise transformation: previously we characterized the Main ORs as having been narrowly transformed (e.g. adding beds to the recovery area). In examining the Administrative Support Services data we established that such characterization is also appropriate beyond the Main ORs. Moreover, we verified and extended our finding from the Main ORs. Examples we discussed included interviewee assertions that senior leadership had only focused on adding beds in the recovery area, and was now thinking of adding an OR to the Neuro ORs, however staff levels had remained the same, and attention hadn't been given beyond the ORs (e.g. patient pre-assessment phase).

Variable organizational learning capability: previously we characterized the Main ORs as having poor organizational learning capability. In examining both the data and the reasoning behind the cross departmental and service unit management boards, we established that the Cardiac ORs were said to be following practices akin to those of organizational learning. Furthermore, the very decision to replicate said practices at a hospital enterprise level via the already mentioned management boards, is in itself evidence of Hospital ABC early steps towards potentially becoming a learning organization. Hence, when comparing the sub-architectures of the Main ORs and the Administrative Support Services, it is evident that there was a variable organizational learning capability at Hospital ABC. Notably, as per the data from this embedded unit of analysis, it seems that the Cardiac ORs are also further evidence of this variability[184].

In examining the above elements, both new and changed, as well as the ones that remained unchanged, as with our characterization of the Main ORs sub-architecture, it is apparent that several EA View interactions are taking place at an enterprise level. The previously described EA View interactions (see section 8.4.3) are still applicable, while the following are additional:

[184] The Cardiac ORs are examined in detail in the next section.

- Senior leadership's poor service architecture awareness (i.e. Service View) was informing their narrow enterprise transformation (i.e. Strategy View) as well as driving them to institute narrow enterprise process improvements (i.e. Process View) and holding the Main ORs as the primary source of the waiting lists problem, which reflected Hospital ABC's "us vs. them" culture and further contributed to the Main ORs stressed climate (i.e. Organization View).
- Senior divisional management understood that enterprise change couldn't only be done at the process level (i.e. Process View) and that incentives had to be in place to support both the required changes, as well as the general concept of maximizing patient throughput (i.e. Organization View).
- As with the case of the Main ORs the NHS 18 Weeks pressure (i.e. External / Policy View) ultimately lessened Hospital ABC's ability to generally support organizational learning practices (i.e. Knowledge View). Similarly, service units already working flat out and under stressful conditions (i.e. Organization View) have less availability to track performance data (i.e. Process View), thus further lessening both organizational learning (i.e. Knowledge View) and service architecture awareness (i.e. Service View), and ultimately not informing senior leaders' transformation plans (i.e. Strategy View), or the Lean Team's process improvement plans (i.e. Process View), or the cross departmental and service unit management boards (i.e. Organization View). Finally, these EA View interactions were further exacerbated by the inherent limitations of Hospital ABC's information architecture capability (i.e. Information View).
- The predominant paper-based and fragmented IT systems across service units (i.e. Information View) require that the scheduling and rescheduling of operating lists (i.e. Process View) have extensive and stressful human intervention (i.e. Organization View), which is error prone, more likely to generate inefficient solutions, and ultimately affects information and patient flows, as well as patient and physician experience (i.e. Service View).
- The preceding description needs to be balanced with the fact that some clinicians elected to use paper even though they could use the electronic system, which would allow to centralize at least all scheduling related information. Hence,

clinicians' local process optimization behaviors (i.e. Process View) weren't making full use of Hospital ABC's information architecture capability (i.e. Information View). Additionally, the fragmented Hospital ABC divisional structure (i.e. Organization View) reinforced the fragmentation of its IT architecture (i.e. Information View) as different service units adopted different IT solutions across redundant functions.

- The previously noted fragmented divisional structure (i.e. Organization View) is conducive not only to the potentially negative local process optimization behaviors (i.e. Process View) but also the poor service architecture awareness/ appreciation (i.e. Service View) and if not also the lessened organization learning practices, then most certainly the inability for Hospital ABC as a whole to progress towards becoming a learning organization (i.e. Knowledge View).
- The decision to institute cross departmental and service unit management boards was early evidence of practices akin to those of a learning organization (i.e. Knowledge View) as they were attempting to replicate the practices of a service unit that had higher performance. Specifically, they hoped to bridge across the different management structures (i.e. Organization View), build a shared awareness/appreciation of the service architecture (i.e. Service View), and drive enterprise level process improvements (i.e. Process View).

All in all, our enriched understanding of Hospital ABC's enterprise architecture allowed us to further establish that the Main ORs issues neither resided only at a process level nor only within its boundaries. Additionally, we determined that several of the Main ORs enterprise architecture dysfunctional elements were also present in other service units and divisions of Hospital ABC, and had impacts beyond those identified previously (e.g. limited process measurement capability and narrow enterprise process improvement). However, we also characterized EA View characteristics that were aligned with lean enterprise principles (e.g. cross departmental and service unit management boards; service architecture awareness; organizational learning; etc). Notably, several of these lastly mentioned EA View characteristics were said to have been the result of Hospital ABC wanting to replicate the practices of the Cardiac ORs, which were said to have led

to the service unit's improved performance. Conversely, the Neuro ORs were consistently singled out as the worse performing service unit. Hence, our exploratory research proceeded to examine in detail the sub-architectures of the Cardiac ORs and Neuro ORs, and hopefully make further progress towards answering this thesis' remaining research question, namely: ***Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?***

8.6 *Theoretically Sampled Operating Rooms*

Over the course of the previous sections we identified that the Main ORs had different organizational arrangements compared with other ORs housed in different divisions. The Main ORs are part of the Surgery and Critical Care (SCC) division, and are shared by several surgical specialties. Notably, specific surgical specialties (e.g. cardiac and neuro) are part of their own divisions (e.g. Cardiac and Neurosciences) and have dedicated ORs, which may or not be managed by their own division directly. For instance, the Cardiac and Neurosciences division have dedicated ORs, but these are managed by the Main OR Coordinator, who ultimately is accountable to the division director of SCC. Furthermore, as previously noted, some specialties with dedicated ORs may share OR space provided by the Main ORs. Finally, in our analysis of the Administrative Support Services we determined that the Cardiac ORs were considered to have higher performance, which stemmed from its practices that were now being replicated by the ORMB and ORISG management boards, whereas the Neuro ORs were regarded at the opposite end of the performance spectrum. In this section we examine in further detail the sub-architecture of each of these service units.

8.6.1 Cardiac ORs

The Cardiac ORs are part of the Cardiac and Neurosciences division and are considered to be the best performing elective surgery service unit at Hospital ABC. They are located on the same physical floor as the Main ORs, and have two dedicated ORs as well as a cath lab, and don't use any of the operating rooms in the Main ORs. However, Cardiac ORs' physical plant, as well as nursing staff, is dependant on a different division (i.e. SCC). A total of two interviews were conducted with Cardiac ORs staff, namely with the lead surgeon and its clinical coordinator[185]. Both interviewees allowed for audio recording and observation of Cardiac ORs operations (i.e. service unit functioning as opposed to actual OR procedures)[186].

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[185] It is important to note that the interviewee was a senior nurse which practiced in the ORs and also coordinated operations. However, she ultimately had to answer to the Main ORs Coordinator.

[186] The Chapter's main text will include key interview excerpts to support the findings from the analysis. For additional excerpts please refer to c.

Figure 8-7 is an overview of our characterization of Hospital ABC's Cardiac ORs sub-architecture which emerged from the data analysis presented in the next subsections. This characterization concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the Cardiac ORs) as well as enterprise level (i.e. pertaining to Hospital ABC as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[187]). The circle placement of the EA Views is meant to illustrate that they are interconnected.[188]

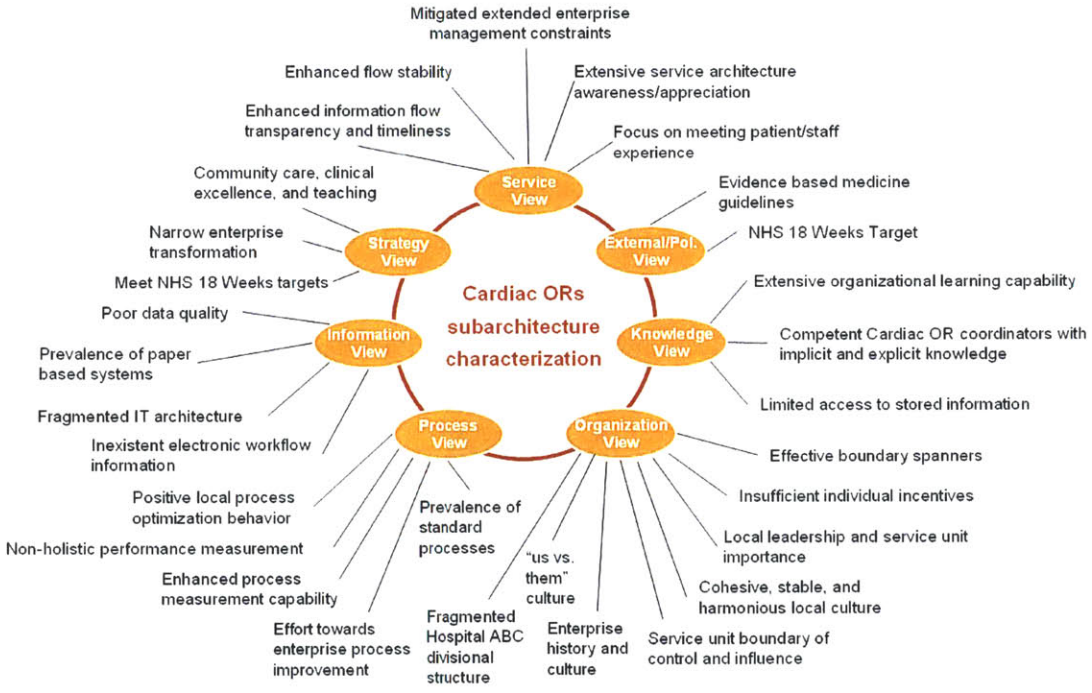

Figure 8-7: Hospital ABC Cardiac ORs sub-architecture characterization[189]

[187] See section 7.7.2.

[188] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 8.6.1.8 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions.

[189] In section 8.6.1.8 we compare and contrast this section's sub-architecture characterization with the one previously discussed in the context of the Main ORs. In our comparison we leverage the use of data visualization techniques to help the reader readily identify key similarities and differences across the sub-architectures.

8.6.1.1 Cardiac ORs External/ Policy View

In describing Hospital ABC's external environment both the lead surgeon and the clinical coordinator shared the perspective previously described by the Main ORs (see section 8.4.2.1) in that they were under pressure to meet the NHS' 18 weeks target, so much so that surgeons would share the procedural load amongst them in order to make sure that they met the target. In general, interviewees felt that they were successfully meeting the targets and that Hospital ABC's senior leadership was happy with their performance.
In describing their regulatory environment both surgeon and nurse noted that they followed evidenced based medicine guidelines, and it wasn't merely the case of keeping them in mind, but rather actively studying them and keeping themselves up-to-date.

8.6.1.2 Cardiac ORs Strategy View

Only the lead surgeon referred to Hospital ABC's strategy. It is important to note that the surgeon also accumulated the function of Medical Director, hence he was part of senior leadership and actively practiced in the Cardiac ORs.

In terms of Hospital ABC's strategy content, the cardiac surgeon provided a similar assessment as his colleagues in the Main ORs. Specifically, he elaborated on the hospital's mission to serve the surrounding community, while at the same time striving to maintain its clinical excellence and international recognition. However, he commented that stakeholders generally agreed with the hospital's mission of placing the patient first, but he questioned whether everyone had a similar interpretation as to what it meant, and whether or not they consciously followed it in their own practice. As for training, the cardiac surgeon's assessment was slightly different given that the NHS had recently narrowed the number of available training positions in cardiac surgery, therefore the department wasn't planning to grow its existing training program.

> *"If you pinned it to the front door here "the patient comes first" nobody would disagree... the real challenge for us is what does that mean? What does that mean for you? Your behavior? Your attitude? And how would you do that with other people?"*
>
> Hospital ABC Cardiac ORs Surgeon

Additionally, the cardiac surgeon shared interesting insights with regards to Hospital ABC's strategy process. To begin with, he described the hospital, along with the NHS in general, as being traditionally risk averse and instituting a philosophy of having to go through several business cases before trying anything. The surgeon felt that Hospital ABC didn't take full advantage of it being a Foundation Trust, and that it spent a considerable amount of time in the planning stage and that it should consider shortening its execution cycles (i.e. instituting a trial and error approach). Furthermore, he commented on how senior leadership seemed to be detached and/or unaware of its enterprise capabilities and organization, as evidenced in their inability to roll-out initiatives beyond two or three departments.

8.6.1.3 Cardiac ORs Service View

The Cardiac ORs' inflow interacts extensively with the Main ORs as it uses its Holding Bay (i.e. they are located on the same floor next to each other) in order to receive patients from the inpatient service units. In terms of outflow, the Cardiac ORs have their own Cardiac Recovery Area which interact directly with the inpatient service units. Therefore, Cardiac ORs are also interdependent within Hospital ABC's overall service architecture.

<u>The Cardiac ORs staff had a shared concern towards patient experience and a common perspective on how to deliver it</u>

Both interviewees were consistent in their concern towards the patient experience and their assertion that seamless patient flow is essential. The following are examples of this phenomenon:

- Either the clinical coordinator or one of her nurses waits next to the patient before their procedure, and explains to them what they should expect to happen. Moreover, they make sure that patients feel comfortable and less anxious. Furthermore, surgeons and anesthesiologists are aware that patients tend to forget things just before and after a procedure, hence they make sure to involve their families, and repeat things several times..
- Recognizing that the Main ORs Holding Bay doesn't always function as it should (i.e. it refuses to call patients in a timely fashion so as to avoid holding them for

too long), the clinical coordinator makes sure that the patients are called for well ahead of time (i.e. 1 hour)[190]. Furthermore, she created an additional space buffer just outside the ORs, thus further reducing the potential for the Holding Bay to hinder patient flow.

- The surgeon expressed an interest in maximizing the usage of ORs and that he would keep them running longer if he could. However, he also observed that it is unreasonable to demand of patients to undergo procedures too late or too early in the morning. Moreover, enhanced throughput shouldn't come at the cost of patient experience.
- Both clinical coordinator and surgeon stated everyone's commitment in the Cardiac ORs to do all their effort to avoid cancelling a procedure because of the negative impact caused on patients and their families.

"If you get the impression that not everybody in the team is committed to maximizing the output for the patient, the benefit for the patient, and above all else, the second worse thing that can happen to an operative patient, other than the operation not going well, is cancellation. You are pumped up in every way, your family are pumped up, the phones are ringing all over the country,' how is he doing?, it is real!' And then they say 'Oh it is not happening! And they are not sure when it will and the surgeon doesn't have a list until next week!' and vrrrrrrummmmm it is like a soufflé hitting the ground"

Hospital ABC Cardiac ORs Surgeon

<u>The Cardiac ORs staff demonstrated extensive service architecture awareness in day-to-day operations</u>

Unlike the specialties in the Main ORs, clinical staff in the Cardiac ORs demonstrated extensive service architecture awareness in their day-to-day operations. Both surgeons and nurses made an effort to compensate for the misaligned schedules across service units, and were committed to finding ways to support seamless patient flow. The

[190] The Cardiac ORs calling patients well ahead of time didn't necessarily mean that they were gaming the system (i.e. saying that they were planning to have the procedure earlier than the actual start time). Instead, it was a proactive decision to enhance the communication between the Cardiac ORs and the inpatient service units, as well as with the Holding Bay in the Main ORs, and allow them to give themselves time to ready the next patient, or to update them on how well the Cardiac ORs were running (e.g. letting inpatient service units know if they were running behind/ahead schedule).

following are examples of this phenomenon:

- Surgeons as well as junior doctors interact extensively with patients both in outpatient settings (i.e. clinic) as well as inpatient service units and the Cardiac ORs. An effort is made to use the same clinical team to perform a procedure and to round on the patients in the morning. As such, surgeons who have the first procedure of the day will come to the hospital earlier in order to round on the first patient. Notably, surgeons alternate operating lists so that each takes equal share of morning and afternoon lists, therefore making the work effort comparable across surgeons and their teams. Furthermore, cardiac instituted a practice of patient pre-assessment within 5 days of their scheduled procedure. A shorter pre-assessment timeframe allowed for test results to remain viable for the day of the procedure. Conversely, the Main ORs didn't have a standard pre-assessment timeframe and it contributed to last minute patient cancellations due to health status changes.
- Surgeons don't generate ambitious operating lists as they understand the potential negative implications of doing so (e.g. overrunning lists; cancelling patients; repeating tests; etc). Furthermore, the clinical coordinators verify each proposed list and will warn and indeed resist surgeons, if the lists are overloaded.
- Role definitions are clear with regard to who should call the Main ORs Holding Bay for the next patient, and whom should call the Cardiac ORs Recovery Area. Both types of calls are made in a timely fashion so as to avoid patient flow delays and last minute solutions.
- Clinical coordinators arrive at 6.30 am in order to check available beds in different service units (i.e. inpatient and ICU). Coordinators make arrangements to reserve beds and ensure that there aren't any late procedure starts due to lack of beds. Furthermore, they plan ahead any required patient moves from cardiac recovery to the ICU, in order to make room for an additional cardiac procedure. Moreover, they engage other service units in a timely manner and negotiate bed availability in order to maximize patient throughput.
- Clinical coordinator instituted the practice of calling for patients well ahead of time, and created a space buffer just outside the ORs in order to keep patients

temporarily. As such, the Main ORs Holding Bay, as well as the inpatient service units, has a reduced potential of slowing down its patient flow.

- Clinical coordinator changed the practice of nurses accompanying anesthesiologists with patients to the recovery area. Instead she instituted the practice of junior doctors assisting anesthesiologists in that task. As such, an additional nurse became available to help with the OR cleaning, turnaround, and patient prepping.
- The Cardiac ORs are faced with the same constraint as the Main ORs in terms of not having dedicated inpatient service units. In other words, often times patients are discharged from the cardiac recovery area to a different inpatient service unit than where the patient originally came from. Hence, the same issue exists of not being able to centralize expertise, easily round on patients, and share information seamlessly. However, the lead surgeon instituted two operating nurse assistants who essentially work as physicians and visit the relevant inpatient service units each night and discuss with them what is going to happen the next day in terms of Cardiac OR procedures. The result is that inpatient service units are better able at having patients ready on time and at making room and retrieving them on time.
- The cardiac lead surgeon said that the Cardiac ORs were already running with high efficiency and that several adjustments were continuously made to support the interactions with other service units, and maximize throughput with them as well. However, he warned of the issue that higher throughput means less time to clean, greater potential for infections, and ultimately may jeopardize Hospital ABC's effectiveness as a whole. Ultimately, he suggested that if Cardiac ORs were to run longer even greater patient throughput could be achieved, but then additional recovery and inpatient beds would be necessary.

"if getting the patient ready is not a rate limiting step, or in theory it shouldn't be, that is what the holding area is... you put the space in a non critical, non costing, and non revenue based area. Don't waste time not operating because the patient wasn't ready... get the patient ready early... that is costing us nothing... and hold them. Hold them in readiness so that the minute you call... vrrummm."

Hospital ABC Cardiac ORs Surgeon

"if it is an overloaded list I can say that I am not happy to do that list because I cannot accommodate that many cases in one day. I can speak with the consultant and say that I am not able to do 7 cases in one day, rather than cancelling on the day. Usually 99% of the time we are okay but I always check to see if there is a problem with the list."

Hospital ABC Cardiac ORs Clinical Coordinator

*"Extend the theatre list, more cases get done, more recovery is needed, more wards are needed, more ICU is needed, more of everything is needed. It does not have to be quite like that because if you look at the specialties it does not always work in that way.[...] if we do another 9% more inpatient work next year there will have to be in bunk beds and on the roof and a lot of other things follow. If you use those beds as fast as we do, cleaning goes down, infections go up, s*** happens, you are in the papers... the system is running very fast"*

Hospital ABC Cardiac ORs Surgeon

"When you talk to surgeons the thing that bothers them most is what they believe to be restrictions on their ability to do things 'The system won't let me!'. And very often they will say that the system does not allow me to offer my patient optimal care..."

Hospital ABC Cardiac ORs Surgeon

8.6.1.4 Cardiac ORs Process View

Service architecture dysfunctionalities generate localized process optimization behaviors which may have a positive global impact

As with the analysis of the Main ORs, the Cardiac ORs exhibited localized process optimization behaviors in response to service architecture dysfunctionalities. The key difference is that Cardiac ORs optimizations were mindfully devised to improve interactions with other interdependent service units.

Additional Cardiac *holding area*: the clinical coordinator explained that a key contributing factor for the Cardiac ORs not having procedure cancellations was the creation of a mock patient holding area. Only two patients would be held in the area at any given time (i.e. cardiac only has two ORs) and they wouldn't be held there for longer than 10 minutes. That in turn relied on the clinical coordinator calling the Main ORs

Holding Bay in an adequate timeframe (i.e. had to call them soon enough but not too soon, otherwise the patient would take up space in the Main ORs). Finally, the area itself was a previously unutilized area just outside the ORs. The end result was that the Cardiac ORs were able to reduce the potential of other service units slowing down its patient flow influx.

Empowered physician assistants: although the term doesn't exist in Hospital ABC, the lead surgeon referred to nurses as physician assistants, in that they were able to make decisions that Hospital ABC normally required physicians to do. Specifically, Cardiac ORs added/converted two operating nurse assistants to visit specific inpatient service units each night and discuss with them what was going to happen in the next day in terms of Cardiac OR procedures, and how they needed to interface. The end result was that the Cardiac ORs assisted the inpatient service units with additional information so as to make sure that they readied patients on time and made beds available as well as retrieved patients on time after the procedure.

Earlier work hours: both surgeons and the clinical coordinator start their day earlier than the clinicians in the Main ORs. This allows for them to interface with other service units in the morning and address any potential issues that might have arisen during the night (e.g. emergency patient took over a bed; patient catching a cold; etc). The end result was that the Cardiac ORs took it upon themselves to become better aligned with other service units and further support information exchange and patient flow.

<u>The Cardiac ORs had a prevalence of process standardization and clear role definitions</u>
The Cardiac ORs followed a practice of standard processes and clear role definitions so that not only every stakeholder knew what was meant to happen at any point in time, but they would also execute it in an efficient manner as possible. The following are key examples:

Standard surgical kit prep: the Cardiac ORs had standardized surgical kit cards specifying the required instruments for any procedure and for each particular surgeon.

Surgical kits for each day were prepared the previous evening and constituted the nursing staff's last activity for the day. In the event that an instrument wasn't available to complete a surgical kit, the nurses would leave a clear note to that effect, so that the clinical coordinator in the morning could sterilize the instrument or find an alternative solution. Surgical kits were seldom prepared incomplete the night before as clinical coordinators kept close inventory of each surgical kit, and had continuously adjusted it to reflect the required procedural volume.

Standard process definitions: both nurses and surgeons know who is responsible for calling the cardiac recovery area, as well as the Main ORs Holding Bay, in order to share information both upstream and downstream. A clear communication protocol is established inside the OR, starting with the surgeon and the anesthesiologist agreeing that the patient can be woken up, who then communicate with the OR nurse who will contact directly cardiac recovery, and will have the clinical coordinator contact the Holding Bay.

Standard workflow checklists: the Cardiac ORs had a series of standardized workflow checklists applicable to both within and beyond their boundaries. For instance, before calling the Holding Bay for the first patient, the clinical coordinator checks if the surgical kit is ready, if there has been any last minute staff changes, etc. Similarly, the cardiac recovery area only calls for the inpatient service units to pick up patients once they verified that the post operating notes have been written by the surgeon, and a porter is available to help transfer the patient.

Standard procedure lists: both surgeons and clinical coordinators have an empirical based estimate as to how long each type of procedure is likely to take. They also take into account the individual surgeon's characteristics (i.e. surgeons vary in their speed). As such, knowing that they have a fixed number of ORs, and a mostly fixed number of procedures (i.e. there may always be an emergency case that requires list adjustments), procedure lists are scheduled with an adequate load. Both lead surgeon and clinical coordinator have to agree on the next day's procedure list volume.

Standard procedure start times: all clinicians shared the understanding that the first procedure of the day should start at 8 am, and that everyone had to be present on time. Similarly, in the event of a clinical team changeover (e.g. two teams operating in the same OR in one given day), these would take place at an agreed time (i.e. depended on the length of the previous procedure) and everyone would be ready.

> *"And it should be a standard also at what time people start... some people come late... some people come early... there was no standard protocol. I said that everybody should start at 8 o'clock. It does not matter who".*
>
> Hospital ABC Cardiac ORs Clinical Coordinator

<u>The Cardiac ORs' process improvement and planning practices were constrained by enterprise level fragmentation</u>

As previously noted, the Cardiac ORs took it upon themselves to change processes in order to better support patient throughput and ensure an adequate patient experience. To that effect, they specifically adopted solutions that they had control over. These process improvements were planned in the context of the Cardiac ORs required patient throughput (i.e. to meet the NHS 18 Weeks target) and a continuous assessment of areas requiring adjustment, both within and beyond their physical walls.

We have already described several of these improvements, including the careful standardization of processes, as well as clear role definitions, and cardiac staff tasked with physically assisting interactions with other service units (i.e. visiting them onsite, sharing information, troubleshooting, etc).

However, despite the Cardiac ORs efforts, there were improvement and planning limitations that emerged at an enterprise level. Essentially, the lead surgeon explained that each division would function independently of each other, often times pursuing different goals and implementing changes without external input. Similarly, the Cardiac ORs would have liked to be able to influence the adoption of standardized practices at other service units, so that they in turn would function in a stable manner and require less

intervention from Cardiac ORs staff.

> *"This is typical of [Hospital ABC] because, there are possibly, and I say possibly because I only know of 3, there are possibly 5 groups trying to do the same thing in their own area at the same time and that is one of the big symptomatic things about [Hospital ABC], because several things follow from that. [...]They are not able to pinpoint the outcomes of the changes because other things are changing around them."*
>
> Hospital ABC Cardiac ORs Surgeon

The Cardiac ORs experienced performance measurement process and content issues due to enterprise level constraints. However, the service unit had implemented good local performance measurement practices beyond those required or enabled at enterprise level

As with the Main ORs surgeons, the lead Cardiac ORs surgeon expressed an interest in accessing financial related data (e.g. how much income is the department generating for Hospital ABC?) but was consistently denied access by senior management. Notably, the lead surgeon was also the Medical Director[191] for Hospital ABC, and he still didn't have access to the financial data.

> *"The thing you need to focus most on is that money follows the patient. I get paid when I work. If I don't do the work we won't get paid, end of story. We are in business. Now that business is not clear enough. If you could tell me this is your activity, this is your financial input, this is your cost, because your salary is very high compared to everybody else. Make that 100% crystal clear to me [...]I don't get told what my financial return for this institution last year was... I would like to. All surgeons would like to."*
>
> Hospital ABC Cardiac ORs Surgeon

Additionally, the lead surgeon commented on how management uses a narrow measurement of performance by exclusively focusing on the operations dimension. In the context of the Cardiac ORs it isn't much of an issue because of the level of efficiency and high throughput. However, as Medical Director the surgeon commented on how management pressured Main ORs, and other areas, solely in terms of the number of cases performed by individual surgeons, and with no mentioning of outcomes.

[191] US equivalent of Chief Medical Officer.

"There are some surgeons that are fast... there are some surgeons who are slow... there are some surgeons who are very good... and there are some who might not be so good... but they are not the same four groups. We have very slow surgeons who are very good with very good results. Should they be penalized for being slow? I am not so sure. Do their patients go home with less complications and less readmission? Possibly. [...] Carving them [surgeons] into minutes that really isn't going to work."

Hospital ABC Cardiac ORs Surgeon

Ultimately, the Cardiac ORs had different performance measurement practices than those of the Main ORs, and would mostly remain untouched by management due to its higher performance. For instance, cardiac clinical coordinators and surgeons had a baseline understanding of the length of each procedure (depending on its type and the surgeon performing it) and would not only plan their operating lists accordingly, but also raise a flag to inspect why things deviated considerably from any initial plan. Furthermore, the Cardiac ORs would every month assemble as a group, including all relevant stakeholders (e.g. surgeons, head of nursing, division director, head of perfusion, nurses), and discuss any issues and/or opportunities to further improve the patient experience and throughput.

8.6.1.5 Cardiac ORs Organization View

Hospital ABC had a fragmented divisional structure and experienced a considerable organizational divide amongst senior leadership, management, and clinicians

The lead cardiac surgeon characterized at length how Hospital ABC had become compartmentalized and how senior leadership was perceived by clinicians. To begin with he explained how Hospital ABC is comprised of three main structures with different cultures associated to each one of them. Specifically, there is senior leadership, followed by the division management layer, and finally the clinicians who are associated with different divisions. As a surgeon for Cardiac ORs and Medical Director for Hospital ABC, the interviewee shared insights that cut across all three structures. Notably, said insights were verified once again by triangulating the evidence with that of interviewees from the remaining embedded units of analysis (i.e. the ORMB Chairman, the SCC Division Director, the Main ORs Coordinator, and the two Main ORs surgeons).

As previously noted, Hospital ABC is comprised of eight divisions which may have dedicated and/or shared resources. Each division functions as a semi-autonomous financial management hub, and no clear reconciliation exists between the different divisions and senior leadership. As such, each division decides how they are going to achieve a particular objective, and doing so with no concern over how they may affect other divisions. All that matters is meeting the bottom line set by senior leadership. Understandably, the cardiac surgeon was of the same opinion of the Main ORs clinicians in that a significant divide existed between clinicians and the other two structures (i.e. senior leadership and management). Additionally, the cardiac surgeon held senior leadership accountable for having created a governance model that allowed for regionalized autonomous structures. The end result was that Hospital ABC didn't have *a way of doing things*, and the absence of said standard further contributed to the fragmentation of relationships and ideas across the divisions.

> *"They allow different systems to develop all over the place because of this degree of almost autonomy of these different areas and knowledge does not get shared, best practice does not get shared, economies of scale, or whatever... but also on top of that there is a feeling of relevant independence... there is no sense that this is the way we do things at [Hospital ABC]."*
>
> Hospital ABC Cardiac ORs Surgeon

With the strengthening of the autonomous divisions senior leadership began having difficulty in rolling out strategic initiatives (e.g. lean transformation teams). More often than not the lean projects would be deployed in two or three areas, and they would fail to propagate elsewhere within the enterprise. Similarly, divisions generally resist senior leadership requests to cut their budgets in equal measure across the divisions. Apparently division management argued that their functions and associated systems were different, hence required a customized approach that didn't fit with an enterprise wide initiative. Furthermore, senior leadership was criticized for only supporting its initiatives with top-down emails instructing division management that projects should cascade into other areas. In other words, senior leadership was only involved at the beginning and failed to motivate and empower projects across the enterprise.

"The adverse of that is if you say you must do this tomorrow... I don't care what it is... you must save 2% of your budget instantly or were in trouble... they all think 'hey you, buzz off, leave me alone'"

Hospital ABC Cardiac ORs Surgeon

Finally, the cardiac surgeon made observations regarding the performance measurement practices of both management and senior leadership. First, he explained that surgeons had been denied access to the financial dimension that would allow them to assess the revenue and cost structure of their activity. Second, as previously noted, the lead surgeon commented on how management uses a narrow measurement of performance by predominantly focusing on the operations dimension (e.g. increasing patient throughput without also considering outcomes).[192]

"The whole of my time here trying to change the culture, and not a lot else, and boy is it impossible."

Hospital ABC Cardiac ORs Surgeon

The Cardiac ORs had a strong local organizational culture and stable climate

In examining the nurse and surgeon responses, as well as in considering the observational data gathered at the Cardiac ORs, there were several elements contributing to a strong local organizational culture and climate. We highlight two of them below followed by more detailed descriptions of the remaining ones.

Balance plant maximization with patient experience commitment: both nursing and surgeon spoke of a local culture of staff being fully committed to do whatever possible to avoid cancelling procedures. Careful attention was given to identify waste (i.e. "*dead air*") and make sure that everyone was on the same page with regards to prompt start times, turnarounds, patient transfers, etc. Similarly, surgeons propose operating lists that

[192] Notably, Hospital ABC's senior management narrow measurement of performance is related to our findings pertaining to RQ1 and RQ2 from Chapter 6. Specifically, the weren't aligned with our recommendations of "Adopt[ing] a multidimensional performance construct that considers value expectations and contributions of relevant stakeholders within and beyond hospital infrastructural boundaries" and "Measur[ing] performance dimensions holistically while adopting practices that manage and influence relevant stakeholders within and beyond hospital infrastructural boundaries".

are reasonable and unlikely to overrun. Additionally, even when a case does overrun due to unforeseen complications, both the surgeon and the nurses stick together and make sure that they work the additional 2 or 3 hours in order to finish the list. Also, the clinical coordinators will readily join a procedure in order to take over for a last minute shortage of staff. More broadly, everyone shares the core objective that patient care comes first and that any cultural differences amongst clinicians need to be addressed and resolved in a timely manner. Finally, if someone persistently is unsupportive of the local culture of balancing plant maximization and patient experience, both the clinical coordinator and the lead surgeon will let them know that such is the case and advise them to consider working elsewhere[193]. All in all, the Cardiac ORs made the necessary effort to avoid patient cancellations, and in doing so they attended to the patient's experience (i.e. avoided cancellation) and to making the most of their available plant (i.e. conduct as many procedures as possible). However, they were cognizant that if taken to extremes one objective could deteriorate the other (e.g. maximizing throughput could potentially imply less *humane* care); hence their culture of balancing the two elements.

> *"I personally think our theatres should run from 7 in the morning to 9 at night, not necessarily with the same surgeon, you wouldn't fly a plane like that either, but we should maximize the use of the plant. [...]As long as everybody is trying to avoid that situation [i.e. cancellations] then we are all happy, and when things happen, then we just have to say 'I am sorry we couldn't do it'. But when you get the feeling that somebody just doesn't want to go the extra mile, doesn't care, isn't focused on that, and is really just trying to get home early and have a beer, that really pisses everybody off!"*
>
> Hospital ABC Cardiac ORs Surgeon

> *"I say 'if anybody not happy to follow my lead, you can go anywhere'. I can tell them to go somewhere else. It is not my decision to say whether they can work here or not, but I let them know that perhaps it is best for them to think of working somewhere else."*
>
> Hospital ABC Cardiac ORs Clinical Coordinator

[193] The clinical coordinator was explicit in clarifying that she was unable to fire someone who wasn't performing. However, she did say that the Cardiac ORs peer pressure and culture was such that people would eventually move on their own account.

Psychological safety: a clinical coordinator feels comfortable to disagree with an operating list proposed by a given surgeon and will openly argue that he must shorten the number of procedures. In other words, the cardiac surgeons respect the clinical coordinators and work closely with them. Similarly, the lead surgeon will identify inappropriate or persistently inappropriate behaviors, whether from nurses or surgeons, and expose them indirectly to the general environment so as to subtly modify their behavior and give them an opportunity to redeem themselves.

> *"We talk about patient focus... in reality what it means in a complex organization is not 'I must be my best' of course I must be my best, but our inter relationships are intense, complex, continuing, so we must somehow be our best together for patient care"*
>
> Hospital ABC Cardiac ORs Surgeon

<u>The Cardiac ORs had an experienced and dedicated clinical coordinator which was well respected by surgeons</u>

The Cardiac ORs clinical coordinator had earned several nurse excellence awards at Hospital ABC and was openly recognized by the cardiac lead surgeon as instrumental for the service unit's high performance and cohesive teamwork. It was clear that the cardiac coordinator was appreciated by surgeons quite in the opposite way than the Main ORs coordinator was.

> *"[The Cardiac ORs clinical coordinator] is a livewire! She is good at her job. You give her a task, she will do it. If she needs to change something she will change it. And if she needs to tell you 'you are being impossible' she'll say 'you're being impossible' [...]the one thing that she made clear at the start, and she has not given up on since, is that she will do whatever she can to do our reasonable quota of work and avoid cancellations".*
>
> Hospital ABC Cardiac ORs Surgeon

The clinical coordinator's came through in her explanations as to how she followed a series of planned steps in order to change the culture and the underlying processes of the Cardiac ORs. When she first joined Hospital ABC she studied the operations for six months and identified multiple dysfunctionalities and opportunities. At the same time she

engaged with her nursing staff and asked them what their role was and whether they had suggestions on how to improve operations. Prior to her intervention, each OR was only able to do one or two cases at most per day. Today it was common to do three cases per OR and sometimes four. She instituted formal role descriptions, standard process protocols, staff inductions, surgeon communication, etc. However, before any change could take place the clinical coordinator worked towards earning each surgeon's trust and respect, hence she worked (and still does so today) alongside them and made sure that she did at least one case a week with each one of them.

> *"I do at least one case a week with each one of the consultants, so I do 6 cases, because they need to see that I am part of them.[...] I just worked with the staff. They shouldn't recognize me only as a manager. I work along with them and then they will get the trust with me, and they will see that I am along with them even though I am both [manager and nurse]. I do cases, I'll clean the theaters, prep the patient to move... it was all to get the staff to know me and my abilities"*
>
> Hospital ABC Cardiac ORs Clinical Coordinator

In addition, the clinical coordinator also leads by example in her commitment towards the Cardiac ORs. As described previously (see section 8.6.1.3), she is the first person to arrive onsite at 6.30 am in order to check last minute changes in bed availability, surgical kit availability, etc and facilitate both intra and inter service unit flow. If need be she will replace a nurse last minute and will often work alongside them in both the most complex and the simplest of tasks. Ultimately, she is committed, supportive of others, and expects everyone to be aligned and deliver on the same objectives.

<u>The Cardiac ORs exercised substantial control and influence within and beyond their service unit boundary</u>

The existence of an experienced and dedicated clinical coordinator allows the Cardiac ORs to function reliably and independently. The clinical coordinators are responsible for ensuring the timely and safe throughput of patients, as well as checking that equipment are set, and that nursing staff is both knowledgeable and motivated. Furthermore, the clinical coordinators have the responsibility of assigning the nursing staff to each

procedure, as opposed to having a surgeon demand specific personnel, or having people solely dedicated to one particular OR.

Although the Cardiac ORs are responsible financially and managerially to the Main ORs, it is important to note specific organizational characteristics which lent it with additional control. To begin with, cardiac anesthesiologists are specialized to such an extent that they are dedicated to the Cardiac ORs, thus lessening the burden of staff scheduling. Similarly, nursing staff although also belonging to the SCC division, are only dedicated to the Cardiac ORs as well. Furthermore, the characteristics of cardiac patients are such that the Cardiac ORs have a dedicated recovery area staffed with specific beds and nursing staff. Moreover, in terms of staffing the Cardiac ORs have dedicated resources and local control as to how to best apply them.

Additionally, the Cardiac ORs are only comprised of two ORs and a cath lab, which is different from the 10 ORs managed by the non-clinical Main ORs Coordinator. The smaller scale and dedicated resources allow the clinical coordinator to not only control its resources more closely, but also to participate actively in the staff training and assisting surgeons during procedures. Coincidently, the lead cardiac surgeon made the case that the Main ORs have a top-down management approach with fragmented management structures which cripple its ability to reproduce the level of performance of the Cardiac ORs.

> *"Now the bigger you get the harder it is for people to negotiate that mess in their own area. 10 theatres divided into several specialty cares, if you manage the whole lot at that micro level from the top, you can't do it, you can't get the buy in, you can't get the people, you can't get the credit. But if you have a team based approach, if you have the right people, you will."*
>
> Hospital ABC Cardiac ORs Surgeon

Finally, despite its smaller scale and dedicated resources, as noted previously, the Cardiac ORs took it upon themselves to institute a series of process and organizational practices which ultimately allow it to function more seamlessly with the remainder of the hospital.

The Cardiac ORs had instituted adequate boundary spanners between themselves and the Main ORs, and inpatient service units

The Cardiac ORs had three key practices that enabled it with adequate boundary spanners to help manage its dependencies with other service units. We have previously described these, namely, the clinical coordinators, the empowered physician assistants, and the consistent rounding/surgery teams. Succinctly, the clinical coordinators arrived early in the day and facilitated information availability with other service units, as would also be the case in the afternoon when they collected the final operating lists for the next day. The empowered physician assistants functioned as physicians in visiting specific inpatient service units each night and discussing with them what was going to happen in the next day in terms of Cardiac OR procedures, and how they needed to interface. Finally, the surgeons that rounded on patients at their inpatient service units, would also perform the designated procedures, thereby further improving communication across service units.

> *"We have two operating assistants who are nurses, and we have two ward assistants who are nurses but not doctors but they are [behaving like] the doctor. So they are like PAs in America, they are Physician's Assistant. [They go to the] ward the night before and say your patient is going to have X tomorrow and we'll need this and this... it is not just to see the patient, get consent, etc but to talk to the ward as well... this is what it is likely to be, this is what we will need, if you have your patient cleaned, washed, ready, and in a gown at 9, we are likely to call at 10, but could you please have the patient fully ready for 9. Instead they [the Main ORs] adopted a just in time approach, oh I think it is 10, lets try to get him ready at 5 to 10, and more often than not it is 10 past 10, and the call comes and they say 'oh he is not ready yet... we... we... weren't sure when you were coming in' that sort of thing."*
>
> Hospital ABC Cardiac ORs Surgeon

Team familiarity was said to help build culture and performance

As with the case of the Main ORs, both clinical coordinator and lead cardiac surgeon valued the ability to foster team familiarity in their service unit. A stable team helps build a likeminded culture and also drives efficiency and quality of care.

"What works well is knowledge. When you have a core of people who know the surgery... know the people... know what they are doing. [...] It is a lot about people... if you are in a team... and the team is good and stable... everybody knows it. Everybody knows the things not to say to each other because they know that is just going to drive him crazy... Or it doesn't have to be the doctors... it could be anybody... You learn that there are ways of behaving together."

Hospital ABC Cardiac ORs Surgeon

"There is no time for the surgeon to ask give me knife, etc. You should know what you are supposed to do"

Hospital ABC Cardiac ORs Clinical Coordinator

The Cardiac ORs staff had multiple individual incentives but generally considered them to be insufficient. Additionally, they regarded NHS' salary structure and labor laws as inadequate, and that these constrained its ability to adequately reward or punish clinicians according to their effort. Finally, the Cardiac ORs emphasized the importance of respecting all staff members

Several of the Cardiac ORs interviewees observations with regards to individual incentives at Hospital ABC were similar to those of the Main ORs. Both the clinical coordinator and the cardiac surgeon were strongly drawn to providing patient care and in working in a prestigious organization such as Hospital ABC. They also mentioned the existence of staff awards which openly recognized the better performing and more dedicated staff members. Additionally, they shared the view that Hospital ABC's salary based system didn't adequately reward people and that not everyone worked as well or with the same commitment.

However, the Cardiac ORs shared additional viewpoints on incentives. They were particularly concerned with respecting all employees (similar to Toyota's *respect for people* principle) and making sure that they had a safe work environment, and that they weren't consistently being asked to work late and compensate for overrunning lists. Furthermore, they felt it was essential to cater for each individual's sense of self-worth in fulfilling their job at Hospital ABC. To that effect, they were particularly concerned with

their limited ability to keep their best employees at Hospital ABC, as these felt that there were limited career progression possibilities. Closer inspection revealed that the issue was wider to NHS's career structuring standards rather than to Hospital ABC alone. Essentially the NHS instituted a band (i.e. level) system that was the same everywhere in the UK, where people would earn the same salary everywhere, and where the number of available slots in each band per each hospital was controlled by the NHS. As a result, some of the best staff would leave looking for better opportunities in other hospitals.

> *"I don't agree with the nurse band progression at all."*
>
> Hospital ABC Cardiac ORs Clinical Coordinator

The clinical coordinator uses alternative means of rewarding her staff by using international training opportunities sponsored by vendor companies. Also, both of the interviewees believe that a respectful and well functioning workplace will keep the best nurses and surgeons loyal to the Cardiac ORs, as they will be less likely to find similar working conditions elsewhere in the NHS.

Interestingly, they also noted the opposite case where it is difficult to manage employees who don't fear for their jobs. Usually it happens when nurses or surgeons reach their highest rank, and years of experience no longer confer them additional progression.

> *"Fear of destitution, fear of not surviving, fear of not coping, fear of losing your job, fear that the organization will collapse or get rid of you or whatever... and under a socialist system you just don't get that... and you don't get that in the whole of Europe, not just the UK. If we underperform in our division what will they do? Will they get rid of us? Will I be sacked tomorrow? Will my pay go in the national pay scale? [Managers] have very few instruments for demeriting somebody. In theory they could take your performance awards away from you and in practice almost never done."*
>
> Hospital ABC Cardiac ORs Surgeon

8.6.1.6 Cardiac ORs Knowledge View

In previous subsections we have noted phenomena pertaining to the Cardiac ORs Knowledge View. The following are key insights:

Hospital ABC as a whole isn't a learning organization

The fragmented divisional structure of Hospital ABC prevents it from defining its *way of doing things*, and instead each division independently strives towards meeting its own bottom line, without sharing information with the remaining divisions, and disregarding potential impacts elsewhere in the service architecture. Similarly, divisions may be faced with a similar problem or objective, but they fail to share their learning, hence often times spending valuable resources reinventing the wheel. Also, divisions were said to be unable to pinpoint the outcomes of their changes given that several parts could be changing at any given moment without their knowledge. Furthermore, those initiatives that are meant to be enterprise wide seldom reach more than two or three departments, as senior leadership aren't active sponsors beyond the initial broadcasting email. Also, leadership sponsored improvement initiatives are associated with putting out fires[194] inside specific divisions, rather than accomplishing an enterprise wide result. Finally, senior leadership and management elected to keep financial information from clinicians who had repeatedly asked for it in the past. Instead, clinicians feel pressured by management with operational metrics (i.e. number of procedures). Moreover, information isn't shared across enterprise levels and performance isn't examined holistically, even though its information content may exist somewhere in Hospital ABC.

The Cardiac ORs had experienced clinical coordinators

Unlike the Main ORs coordinator who is regarded as an ineffective manager by the surgeons and anesthesiologist, the Cardiac ORs coordinator is considered a key pillar in maintaining the service unit's higher performance. Her clinical knowledge (and personal commitment) allowed her to gain the trust of both surgeons and nurses in the Cardiac

[194] The initial exploratory question proposed by leadership for this research is indeed indicative of that (i.e. "How to improve productivity in the operating rooms?"). With a greater understanding of Hospital ABC's enterprise, one can see that the question emerges in the context of the NHS' pressure of 18 Weeks waiting lists and the potential penalties from not meeting that target.

ORs. With that trust she was able to openly discuss system dysfunctionalities and opportunities for improvements. Together with surgeons, the clinical coordinator instituted standard processes, clear role definitions, and a training program for recent hires.

The Cardiac ORs exhibited learning organization behavior

Despite the enterprise level constraint of fragmented divisions, the Cardiac ORs embraced a series of organizational learning practices both within and beyond their service unit boundary. To begin with, every staff member, whether a surgeon or a nurse, shares the same overall objectives of balancing patient experience with plant utilization maximization. Each team member has a well defined role and carries out standardized processes which are available in document format. Similarly, every team member undergoes rigorous training to learn the Cardiac ORs environment as well as how it interacts with other service units. Additionally, regular meetings are held with all members of staff in order to review performance data, improvement suggestions, and any issues that might have arisen. Everyone is encouraged to submit pertinent data and is required to attend these meetings. Said meetings also foster familiarity and improves work relationships. Finally, recognizing the enterprise level constraints of fragmented divisions, the Cardiac ORs began testing and eventually standardizing new roles and new processes that helped information visibility and supported patient throughput.

The Cardiac ORs followed evidence based medicine guidelines

Both nursing and surgeon staff expressed the importance of following explicit knowledge guidelines set by the UK's NICE guidelines and only making deviations if in the context of a wider discussion amongst colleagues. For instance, as opposed to some of the Main ORs surgeons, in Cardiac ORs they consistently performed timeouts. Also, more often than not the surgeons doing a procedure would greet the patient immediately before they were put to sleep, and if it wasn't the senior surgeon doing so, then it would be the most senior surgeon trainee. Finally, the previously mentioned rigorous training for new staff members was also said to follow evidenced based medicine (e.g. different coloring of tubes; participating in a timeout; thorough cleaning between procedures; etc).

8.6.1.7 Cardiac ORs Information View

In previous subsections we have noted phenomena pertaining to the Cardiac ORs Information View. From an infrastructure capability standpoint these were similar to those that were previously described in the Main ORs (see section 8.4.2.7). Specifically, the existence of paper-based patient records, the absence of an electronic workflow information, etc, meant the prevalence of paper-based information systems, and the need for extensive human resource intervention (e.g. pushing paper, using the phone, etc). For instance, the clinical coordinator received via email every Friday the list of procedures for the following week. Said list would also be edited by hand every day by mid-afternoon and require surgeons and junior doctors to plan it, edit a form by hand, and eventually deliver it physically in the Main ORs. Similarly, information wasn't readily available in terms of inpatient service unit availability, and required alternative modes of information sharing.

However, unlike the Main ORs, the Cardiac ORs was able to sustain a stable and high patient throughput while maintaining a visible flow of information within and beyond its boundaries. Also in the previous subsections we highlighted several characteristics that enabled the Cardiac ORs to perform as such. Among others, these included the prevalence of standard processes and clear role definitions (Process View), the existence of boundary spanners (Organization View), service architecture awareness (Service View), and learning organization behavior (Knowledge View). All in all, the absence of an electronic based information system isn't in itself a reason why a hospital enterprise shouldn't be capable of high performance. Indeed, the ability to readily share, search, and execute information, is of added value for hospital enterprises (e.g. care givers can focus on caring for patients rather than pushing paper; anomalies can be more readily detected; etc). However, as evidenced in the Cardiac ORs, one can have higher performance even in the absence of highly sophisticated EMR and electronic workflow systems. Notably, this conclusion replicates our finding of multiple internal architectural configurations from Chapter 7. Specifically, in Hospital XYZ we also found a higher performing internal architectural configuration which had made decisions that compensated for the inherent limitations of its enterprise electronic information systems (i.e. instituted

boundary spanners; routinely collected data on its interaction performance with other service units; physicians and nurses collaborated closely to share information more effectively; etc).

8.6.1.8 Cardiac ORs analysis summary

In this section we presented our analysis of the Cardiac ORs. A total of two recorded interviews were conducted with Cardiac ORs staff, namely with the lead surgeon and its clinical coordinator, as well as evidence collected from observing their operations.

Figure 8-8 is the overview of Hospital ABC's Cardiac ORs sub-architecture characterization presented earlier[195] and pertains to the analysis of the previous subsections. The coloring of the elements in the figure is a visualization technique to readily compare this sub-architecture with that of the Main ORs previously discussed in section 8.4.3. Specifically, black denotes no change from the Main ORs sub-architecture; red denotes new elements; orange denotes previous elements which have changed in some regard. Furthermore, in the descriptions that follow we also directly make comparative references to the Main ORs sub-architecture and the Administrative Support Services sub-architecture[196].

The characterization of the Cardiac ORs sub-architecture concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the Cardiac ORs) as well as enterprise level (i.e. pertaining to Hospital ABC as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[197]). The circle placement of the EA Views is meant to illustrate that they are interconnected.

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[195] See section 8.6.1

[196] For additional detail on each of the Main ORs elements referred to, please see section 8.4.3. Similarly, for the Administrative Support Services elements referred to, please see section 8.5.8.

[197] See section 7.7.2.

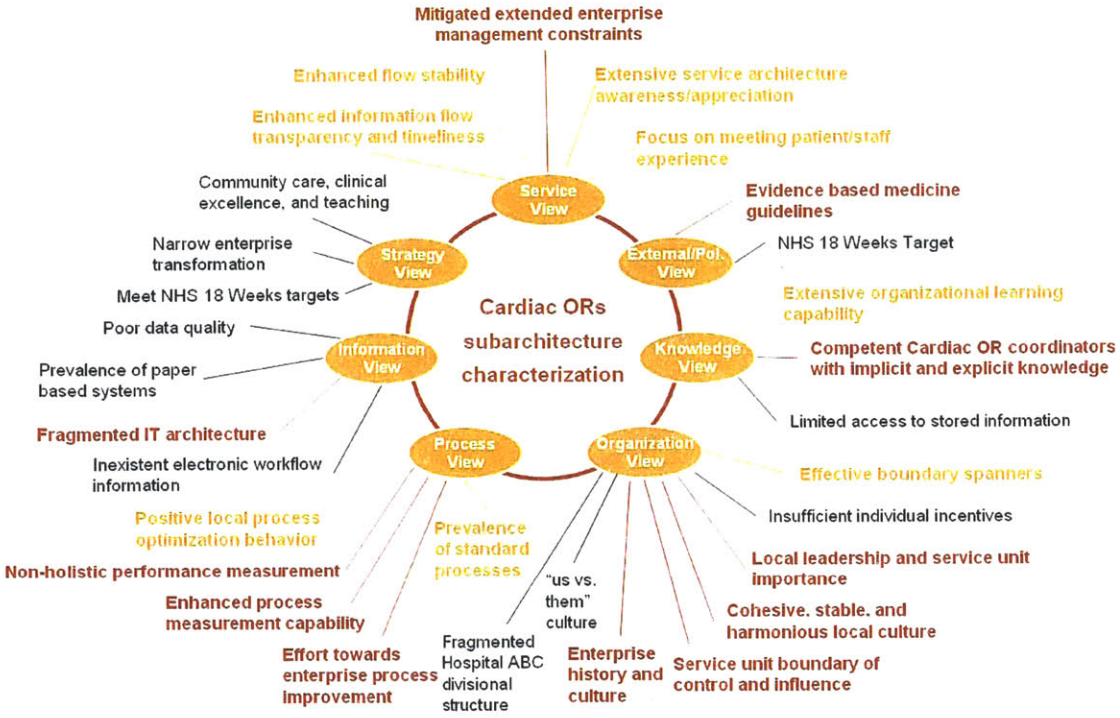

Figure 8-8: Hospital ABC Cardiac ORs sub-architecture characterization

The Cardiac ORs sub-architecture characterization is similar to that of the Main ORs insofar as the Strategy, External / Policy, and Information EA Views are concerned. The service unit is faced with similar external pressures and is aware of the same strategic charter set by Hospital ABC's senior leadership. Furthermore, the similarity of its Information EA View denotes Hospital ABC's overarching information systems limitations which were the same to all of its divisions and service units. Additional similarities emerged from the data regarding other EA Views. In terms of the Organization EA View, similarities persisted regarding the fragmented divisional structure of Hospital ABC and how such contributed to the "us vs. them" culture among senior leaders, managers, and clinicians. Also, further insight was shared with regards to the inherent difficulties of the NHS' salary system, and how it was both difficult to retain the best employees, and penalize those that didn't work their fair share. Finally, the Cardiac ORs equally denoted a desire to have access to financial related information, but reportedly had been denied by senior leadership, which coincided with the Main ORs characterization.

The majority of the new elements (i.e. in red in Figure 8-8) that were identified from the Cardiac ORs data pertained to the Organization and Process EA Views, but also included other EA Views, as follows:

Enterprise history and culture: one of the effects of Hospital ABC's fragmented divisional structure was that it lacked "*a way of doing things*", and such was considered essential to guide the enterprise as a whole. Notably, this element is equally pertinent to the Main ORs.

Local leadership and service unit importance: both the lead cardiac surgeon and the coordinator were leaders in the Cardiac ORs. The interviewed coordinator led by example and had amassed considerable buy-in from surgeons, as well as from the nursing staff. Similarly, the lead cardiac surgeon was well respected and accumulated the role of Medical Director for Hospital ABC. Together, lead surgeon and coordinator were able to shape a strong local culture, and engage with service units beyond the Cardiac ORs' boundaries. Conversely, the Main ORs didn't have the benefit of such clear clinician leadership.

Cohesive, stable, and harmonious local culture: the Cardiac ORs didn't have an internal "us vs. them" culture. In fact, they had quite the opposite. Nursing staff and surgeons worked closely together towards the common goal of maximizing plant utilization and avoiding at all costs cancelling a patient procedure. Examples we discussed included the sharing of work load, the use of reasonable operating lists, prompt procedure starts, the existence of peer pressure to keep everyone engaged and contributing towards the common goal, and the benefits of team familiarity.

Service unit boundary of control and influence: the Cardiac ORs had a dedicated Recovery Area, two dedicated ORs, and dedicated staff. However, they were managerially and financially accountable to the Main ORs, and relied not only on the Main ORs Holding Bay, but also on the inpatient service units, and ancillary services. Hence, locally the Cardiac ORs scaled and aligned their resources to efficiently and

effectively deliver on the 18 Weeks operating target. However, realizing their dependence on stakeholders beyond their service unit boundaries, they also instituted specific practices to engage them, support them, and ultimately influence them.

Mitigated extended enterprise management constraints: the Cardiac ORs influence beyond their boundary was particularly evident in how they engaged the pre-assessment service unit and influenced them to change their practices. By holding pre-assessments within 5 days of a scheduled procedure they were better able to avoid procedure cancellations due to patient symptom changes. Notably, this practice allowed for the reinforcement of the remaining Service EA View characteristics, as well as to other EA Views.

Evidence based medicine guidelines: unlike the Main ORs which had several surgeons who were dismissive of evidenced based medicine guidelines, the Cardiac ORs embraced them at both the nursing and surgeon levels. In fact, these guidelines informed several of their process related practices.

Competent Cardiac OR coordinators with implicit and explicit knowledge: the existence of competent Cardiac OR coordinators was significant beyond their ability to function as effective boundary spanners (detailed further below). Unlike the Main ORs Coordinator, which lacked clinical training and was poorly regarded by both clinicians and some managers, the Cardiac OR coordinators managed and practiced medicine alongside clinicians, and were very well regarded. Furthermore, the Cardiac OR coordinators led by example, supported and shaped the local culture, and very importantly, were able to engage and confront surgeons if necessary. Ultimately, the Cardiac OR coordinators were instrumental towards enabling the service unit's performance.

Fragmented IT infrastructure: as with the Administrative Support Services, the fragmented IT infrastructure emerged from the data as the Cardiac ORs accumulated local management responsibilities (e.g. list scheduling; performance tracking) which both

contributed and reflected the IT infrastructure (e.g. excel sheets, proprietary software, etc).

Enhanced process measurement capability: unlike the Administrative Support Services, and despite similar information system limitations, the Cardiac ORs had instituted local practices that enhanced its process measurement capability. Examples we discussed included: tracking reasons for cancellation/delays; tracking procedure length times by surgeon; regular service unit meetings with everyone present to review performance and discuss deviations; etc.

Non-holistic performance measurement: despite Cardiac ORs enhanced local process measurement capability they were denied access to financial related data, hence their performance measurement wasn't able to leverage the content which existed elsewhere in the enterprise. Furthermore, it was noted that senior leadership predominantly focused on measuring them, along with other ORs, in terms of the operations dimension (e.g. number of procedures).

Effort towards enterprise process improvement: consistent with the Administrative Support Services characterization of the Cardiac ORs, we established that the Cardiac ORs had made successful process improvements that not only impacted their local operations but also those of other service units. Moreover, their approach was distinctively different from that of Hospital ABC's internal Lean Team which focused at a process level within each service unit (as in, not across units).

The following summary analysis concerns the previous elements (i.e. in orange in Figure 8-8) which have changed in some regard as compared to the Main ORs sub-architecture:

Extensive service architecture awareness/appreciation: previously we characterized the Main ORs as having poor service architecture awareness/appreciation. In examining the Cardiac ORs data we established that stakeholders were consistent in their high service architecture awareness/appreciation. Examples we discussed include the influencing of the pre-assessment service unit, the Main ORs, and the inpatient service units. However, several of the Cardiac ORs internal practices were also evidence as they were aware of how their own actions could negatively impact others in the service architecture.

Focus on meeting patient/staff experience: stakeholders in the Cardiac ORs had a common goal of maximizing plant utilization and avoiding at all costs cancelling a procedure. Furthermore, they instituted the core value of self-worth and being respectful towards each other. Examples we discussed include surgeons and anesthesiologists engaging patient family members, nurses sitting next to patients before their procedure, and a shared willingness and commitment towards avoiding procedure cancellations.

Enhanced flow stability: the Cardiac ORs had a significantly smaller cancellation rate than the Main ORs (i.e. < 2% vs. 9%), experienced fewer disruptions to their flow (i.e. last minute rescheduling; delays), and had the highest throughput.

Enhanced information flow transparency and timeliness: despite having the same information system limitations as the Main ORs, the Cardiac ORs had instituted practices both within and beyond its boundaries, which ultimately enhanced its information flow transparency and timeliness. Notably, this element also reflects both the extensive service architecture awareness/appreciation and the mitigated extended enterprise management constraints, and ultimately reinforces the enhanced flow stability and ability to deliver on the patient experience.

Prevalence of standard processes: unlike the Main ORs, the Cardiac ORs not only had standard processes in place, but also followed them. Examples discussed included: operating lists had to be reasonable and red flags were raised if needed; clear role definitions as to who is responsible for triggering a process (e.g. calling recovery area or holding bay); workflow check lists; prompt start times; etc.

Positive local process optimization behavior: unlike the Main ORs, the Cardiac ORs also exhibited local process optimization behavior, but with positive results and whilst aware of their service architecture; hence, although these were local decisions they generated global improvements. Examples we discussed included: the changing of schedules to align capabilities across service units; the placing of effective boundary spanners (discussed below); the timely warning/updates shared with other service units; the improvised local holding bay; the consistent tracking of workflow data; etc.

Effective boundary spanners: unlike the Main ORs, the Cardiac ORs had effective boundary spanners in place. Examples we discussed included: competent coordinators that not only facilitated local operations but also interactions with other service units; empowered physician nurse assistants tasked with physically visiting and coordinating inpatient service units every evening; consistent surgeon team rounding and performing procedures. Moreover, the Cardiac ORs understood the importance of managing their operation within Hospital ABC's overall service architecture, and hence put in place boundary spanners to that effect in key operations interfaces.

Extensive organizational learning capability: unlike the Main ORs, the Cardiac ORs exhibited an extensive organizational learning capability which is best characterized in the context of EA View interactions. Moreover, the service unit's organizational learning capability is the combined result of several decisions that they had made in the context of other EA Views.

Overall, the Cardiac ORs had similar enterprise level constraints as the Main ORs as evidenced in the consistent characterization of key elements pertaining to the Strategy,

External/Policy, Organization, and Information EA Views (i.e. elements pictured in black in Figure 8-8). However, it is clear that while existing within the same Hospital ABC, the Cardiac ORs had made decisions that resulted in a sub-architecture significantly different from that of the Main ORs. Moreover, we characterized several new elements as well as several elements that were different in some regard, as compared to the Main ORs. Furthermore, a holistic analysis of these differences in terms of the EA View interactions they produce, allows us to establish how **the Cardiac ORs had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream**. The following are key EA View interactions of the Cardiac ORs sub-architecture which support our finding:

- The NHS 18 Weeks pressure (i.e. External / Policy View) drove senior leadership to set it as a core strategic objective (i.e. Strategy View). The Cardiac ORs local leadership (i.e. Organization View) exhibits extensive service architecture awareness/appreciation (i.e. Service View) and understands that its unit exists amid Hospital ABC's fragmented division structure, within which the Cardiac ORs boundary of control and influence is defined (i.e. Organization View). To begin with, the Cardiac ORs influenced the practices of the pre-assessment clinic to eliminate cancellations due to patient symptoms changing over time (i.e. Service View). Internally, the Cardiac ORs local optimization process behaviors only became standard (i.e. Process View) if their outcome was positive both at a local level and beyond the unit's boundaries. Similarly, the Cardiac ORs created new positions at key interfaces so that the unit had effective boundary spanners (i.e. Organization View). The changes made at the Process and Organization EA Views, allowed for the Cardiac ORs to improve information flow, enhance patient flow stability, and reinforce its focus in meeting not only patient's expectations but also those of its employees (i.e. Service View). Finally, the benefits attained at the Service EA View subsequently reinforce those of the Process and Organization EA Views (e.g. standard processes need not be broken at the last minute; local climate remains positive and culture strengthens; etc).

- However, the Cardiac ORs local leadership (i.e. Organization View) exhibits not only extensive service architecture awareness/appreciation (i.e. Service View), but also an understanding of both the capabilities and limitations inherent in Hospital ABC's EA, and specifically made decisions to avoid having frustrated employees saying "*the system won't let me!*". In addition to the practices described in the previous bullet point, Cardiac ORs leadership also elected to recruit a competent coordinator (i.e. Knowledge View) who not only was responsible to manage operations but also to practice alongside clinicians. Together, local leadership and coordinators were able to build a cohesive, stable, and harmonious culture (i.e. Organization View) which embraced service architecture awareness, encouraged consensus and participatory decision making, and practiced organizational learning in the pursuit of continuous improvement (i.e. Knowledge View). Furthermore, the Cardiac ORs also adopted practices that enhanced their process measurement capability so as to inform their improvement efforts (i.e. Process View). All in all, the Cardiac ORs sub-architecture was capable of successfully delivering on the goal of maximizing plant utilization and focusing on patient experience (i.e. Service View) whilst aware of Hospital ABC's overall capabilities and limitations.

All in all, we theoretically sampled the Cardiac ORs for their higher performance, as well as for having triggered the creation of the cross departmental and service unit management boards described in our Administrative Support Services analysis (see section 8.5). We determined that the Cardiac ORs had a significantly different sub-architecture than that of the Main ORs, and that such differences were the result of decisions which reflected local leaderships' enriched understanding of hospital enterprise architecture, and ultimately contributed to the Cardiac ORs higher performance.

Next, we proceed to examine the Neuro ORs who were consistently singled out as the worse performing service unit in terms of the previously examined perceptual and objective data (see sections 8.5.3 and 8.5.8). Our intent is to further test our finding that

an enriched understanding of hospital enterprise architecture can inform decisions that ultimately contribute to higher hospital performance.

8.6.2 Neuro ORs

The Neuro ORs are part of the Cardiac and Neurosciences division and are considered to be the least performing elective surgery service unit at Hospital ABC. They are located on the physical floor below the Main ORs, and have three dedicated ORs, and also use an operating room in the Main ORs. Furthermore, similar to the Cardiac ORs, the Neuro ORs' physical plant, as well as nursing staff, is dependant on a different division (i.e. Surgery and Critical Care (SCC)). A total of two interviews were conducted with Neuro ORs staff, namely with the lead surgeon and the lead anesthesiologist. Both interviewees allowed for audio recording and observation of Neuro ORs operations (i.e. service unit functioning as opposed to actual OR procedures)[198].

Figure 8-9 is an overview of our characterization of Hospital ABC's Neuro ORs sub-architecture which emerged from the data analysis presented in the next subsections. This characterization concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the Neuro ORs) as well as enterprise level (i.e. pertaining to Hospital ABC as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[199]). The circle placement of the EA Views is meant to illustrate that they are interconnected.[200]

[198] The Chapter's main text will include key interview excerpts to support the findings from the analysis. For additional excerpts please refer to d.
[199] See section 7.7.2.
[200] The placement of the EA Views in a circle isn't intended to illustrate how they interconnect. Moreover, the EA Views don't simply connect in a sequential manner with the adjacent EA Views in the circle. In section 8.6.2.8 we describe dominant EA View interactions that emerged from the data, and demonstrate the non-sequential nature of said interactions.

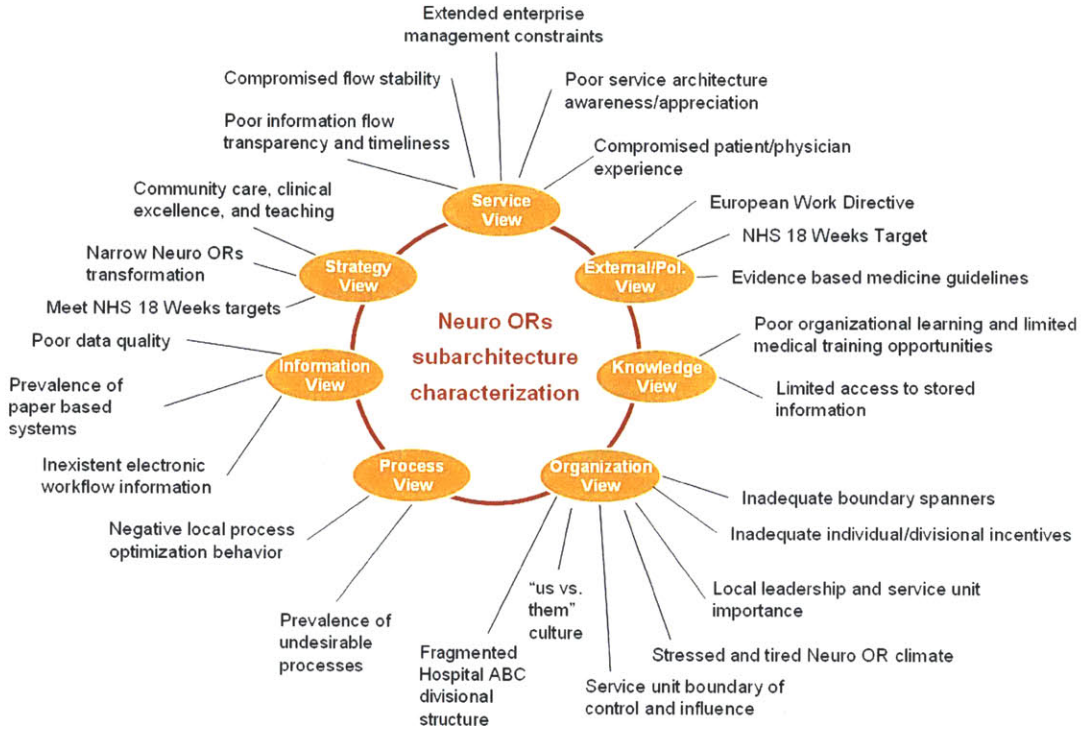

Figure 8-9: Hospital ABC Neuro ORs sub-architecture characterization[201]

8.6.2.1 Neuro ORs External / Policy View

In describing Hospital ABC's external environment both the lead surgeon and the lead anesthesiologist shared the perspective previously described by the Main ORs and Cardiac ORs (see sections 8.4.2.1 and 8.6.1.1) in that they were under pressure to meet the NHS' 18 weeks target. In general interviewees felt that they were unable to meet the demands asked of them and they offered several reasons:

- Neurosurgery was unable to turn away patients referred by the primary care physicians (PCPs) and had to see each and every patient in a specialist consult setting. Apparently, PCPs were inadequately referring patients that should otherwise be treated by PCPs and some combination of physical therapy.
- The European Work Directive considerably reduced the amount of hours that junior doctors were allowed to work. Previously they would work as many as 98

[201] In section 8.6.2.8 we compare and contrast this section's sub-architecture characterization with the one previously discussed in the context of the Main ORs. In our comparison we leverage the use of data visualization techniques to help the reader readily identify key similarities and differences across the sub-architectures.

hours in a week, and now they could only do 48 hours. As a result there were fewer residents available to do night call, fewer residents to support with procedures, etc, and ultimately adding to the responsibilities of senior surgeons. Furthermore, both interviewees felt that the residents were no longer being trained well enough for the responsibilities that they were expected to have after completing training.

- Evidenced based medicine guidelines were beginning to be introduced at the Neuro ORs, which allowed for more robust processes, but also lowered patient throughput. Also related was that malpractice insurance for spinal procedures had become considerably expensive for private orthopedic surgeons; hence they were no longer doing such procedures, and instead referring them to the NHS.

8.6.2.2 Neuro ORs Strategy View

In terms of Hospital ABC's strategy, the neurosurgery clinicians had similar observations to those of the Main ORs. Specifically, they emphasized that there was strategic tension between serving the surrounding community and at the same time striving to remain at the forefront of clinical excellence. The end result is that they were using a highly expensive plant for both simple and complex cases. Moreover, Hospital ABC's neurosurgery clinical care delivery platform wasn't aligned with the proposed strategy.

> *"Get simple patients through an infrastructure designed for complicated patients. We have assumed that all patients are massively complicated."*
>
> Hospital ABC Neuro ORs Surgeon

Furthermore, they noted that their mission as a leading academic medical center was also under threat given that the NHS 18 Weeks target was pressuring them to maximize throughput, therefore making it increasingly difficult to accommodate trainees who are inherently slower conducting procedures.

8.6.2.3 Neuro ORs Service View

The Neuro ORs interact more with the Main ORs than do the Cardiac ORs. The primary reason for this interaction is because neurosurgery felt it needed to share an OR from the Main ORs, in addition to its three dedicated ORs. However, as with the Cardiac ORs, they also rely on the Main ORs Holding Bay in order to act as the initial interface between them and the inpatient service units. In terms of outflow, similar to the Cardiac OR's, the Neuro ORs have their own Recovery Area which interacts directly with the inpatient service units. Therefore, Neuro ORs are also interdependent within Hospital ABC's overall service architecture. Overall, the service architecture dysfunctionalities that emerged from the Neuro ORs are very similar to those of the Main ORs. However, there were additional insights as well.

<u>Neuro ORs have the highest rate of procedure cancellations in Hospital ABC</u>

Both neurosurgery clinicians offered similar numbers in terms of the rate of procedure cancellations. Specifically, the ORs would function five days a week and have at least one cancellation a day, and two cancellations in the same day twice a week. Moreover, there were at least seven procedure cancellations every week, which explains Neuro ORs 18% cancellation rate[202].

<u>Misaligned processes and poor information visibility beyond Neuro ORs compromised patient care and flow</u>

Untimely patient assessments contribute to cancellation rate: The long waiting list for the Neuro ORs has had the implication that patients are pre-assessed too long ago, hence more often than not their symptoms will have changed, and surgeons can only realize that once they present themselves for the surgery at Hospital ABC, and have to cancel them.

[202] An NHS operating list at Hospital ABC is comprised of 3 slots for each day and each Neuro OR. Therefore, the Neuroscience division with its 3 Neuro ORs together with its additional OR in the Main ORs, should ideally be able to conduct 12 procedures every day, or 60 procedures a week. Instead they were only doing 49 cases a week, which meant an 18% cancellation rate. However, they were averaging 1.8 cases a day in the Main ORs and 2.6 cases a day in the Neuro ORs. Hence a 38% and 12% cancellation rates respectively. Clearly, their throughput in the Main ORs was extremely poor, but their Neuro ORs cancellation was also still higher than the Main ORs 9% and much higher than the Cardiac ORs < 2%.

Inpatient service unit patient transfers are unpredictable for Neuro ORs: Both neurosurgery clinicians complained that the inpatient service unit patient transfers were unpredictable and largely because of the Main ORs Holding Bay not functioning in the way they should. As with the Main ORs surgeons (see section 8.4.2.3), the neurosurgery clinicians said that there was a cultural issue in that nurses didn't want to use the holding bay to hold patients. They gave the same argument as before in that nurses preferred to delay calling for patients in order to avoid having them sit uncomfortably in the Holding Bay. However, interviewees said the end result were late starts and cancelled procedures.

Inpatient service units fail to work up patients appropriately: The neurosurgery anesthesiologist explains that it isn't uncommon for the required blood tests not to be ready at the time of the surgery. He holds responsible the junior doctors who are spread thin on the inpatient service units and are unable to send the blood samples in a timely manner to the ancillary services. He also emphasizes that the European Work Directive prevents the junior doctors from starting work earlier, hence further contributing to the potential delay in getting patients adequately worked-up for the surgery. Ultimately, the junior doctor's work (blood drawing and beyond) may shift itself to an already overburdened senior surgeon or anesthesiologist.

Weak patient handoffs between Neuro ORs and inpatient service units: Both neurosurgery clinicians admitted that they don't always make available the postoperative notes, or somehow they never make it to the patient record. As such, inpatient service unit nurses don't know whether patients are allowed to eat, or whether they should try to walk, etc. A compounding effect is that the physicians rounding on the patients in the inpatient service units, are not the same as the ones doing the procedure. Hence, neither nurses nor physicians on the inpatient service units know at times how to care for a patient who has recently undergone a procedure. Ultimately, the patient handoffs between inpatient service units and the Neuro ORs aren't as robust as they should be, and not only may they adversely impact patient experience, but also further compromise patient flow.

The Neuro ORs staff demonstrated poor service architecture awareness in day-to-day operations

Although the neurosurgery clinicians were generally aware of both inflow and outflow limitations inherent in the service architecture, we found them to be nonetheless similar to the Main ORs in terms of a poor functioning of their day-to-day operations.

Fragmented multispecialty care: Despite neuroscience, neurology, and neurology being closely related specialties which often comprise a multispecialty care team for a given patient, the communication between them was said to take place only over fax. Also, interactions with other specialties, such as general surgery, were described in the same manner.

Neuro ORs detached from their service architecture: Confronted with its poor performance levels, the lead neurosurgery anesthesiologist argued that the Neuro ORs had dedicated knowledgeable teams, and provided that everything was in place, these would be able to perform efficiently. Moreover, the Neuro ORs considered themselves efficient and the source of trouble was specifically in its interactions with other service units, and generally for reasons beyond its control. So much so, that the anesthesiologist confessed that he didn't have a systems view beyond his own service unit.

> *"we don't have a big picture of how main theatres work. It seems that there are lots of difficulties that I can see from on the outside."*
>
> Hospital ABC Neuro ORs Anesthesiologist

8.6.2.4 Neuro ORs Process View

On the whole, the Neuro ORs Process View analysis was very similar to that of the Main ORs (see section 8.4.2.4).

Service architecture dysfunctionalities generated localized process optimization behaviors

Faced with the pressure of ever increasing procedure waiting lists and the existence of

service architecture dysfunctionalities, stakeholders within the Neuro ORs found themselves optimizing processes locally without regard to the potential implications stemming from their behavior. As with the case of the Main ORs, the Neuro ORs struggled with incomplete surgical kits because of the last minute procedure cancellations and having to create new kits on the fly (i.e. poaching instruments wherever available). Also, the staggering and increasing long waiting list was driving surgeons to generate over ambitious lists, which as with the case of the Main ORs disrupted flow (i.e. 18% cancellation rate) and added pressure to an already anxious OR staff. Similarly, some neurosurgeons would consistently fail to submit their post-operative surgical notes, which would require Recovery Area nurses, as well as those from the inpatient service units, to track down the surgeons in order to complete a handoff. All the while, patients would either remain unnecessarily in a given location, or experience delays in their treatment once back at the inpatient service units.

> *"Things seem to go surprisingly wrong sometimes... you think if you would have the same list and cases all the time that they would have enough kit, operating equipment, and stuff like that, but sometimes you will find that some things are missing, and that things are disorganized"*
>
> Hospital ABC Neuro ORs Surgeon

Service architecture dysfunctionalities caused last minute suboptimal decisions

In some cases, rather than generating systematic localized process optimization behaviors, service architecture dysfunctionalities call for last minute decisions, which ultimately also have suboptimal results. Once again, similar to the Main ORs, the reshuffling of procedures in the Neuro ORs implied a potentially untimely pressure on inpatient service units and ancillary services (i.e. external service units would have to scramble in order to attend to readying an unscheduled patient). Additionally, surgeons could find themselves operating in a sequence which wasn't according to their preference (e.g. having to do a simple case first, rather than a hard one) and in some cases even taking risks that could potentially harm the patient (e.g. doing a procedure without a spinal orthopedic surgeon being present as there wasn't enough time to get them to the procedure).

External policies significantly constrained key Hospital ABC processes

As with the Main ORs, the neurosurgery clinicians made reference to the constraints imposed by the European Work Directive[203] and how they had to do more with less. For instance, junior doctors responsible for doing patient blood drawing and sending them for analysis, wouldn't be readily available to do so, thus causing procedure delays or even requiring senior clinicians to do the blood drawing for them. Similarly, they realized that their handoff with inpatient service units wasn't as robust as it should be given that post operative surgical notes would fail to make their way to patient medical records, and there wasn't a failsafe in place because there weren't enough work hours to allow for the same people to operate and round on the same patients.

> *"Blood drawing is a little chaotic... frequently patients will come to us and their second blood sample has not been done. Because the house officers are doing whatever they are doing they say they can't draw the sample, etc, so we'll have the anesthesiologist do it. Houseman does not do his job because it is too late, he is overworked, or had to go home, so the workload gets shifted to consultant"*
>
> Hospital ABC Neuro ORs Anesthesiologist

OR scheduling complexity required considerable effort to make adjustments

The Neuro ORs rescheduled approximately 1 in every 5 procedures and each time they would undergo a complex process which required considerable effort. The source of complexity is the same as the one previously described for the Main ORs. Specifically, many factors had to align themselves perfectly across multiple service units and organizational structures in order to make any readjustment. Additionally, going through such readjustments didn't always mean that the procedure would indeed be carried out because it might be that it is too late in the day to start a new procedure.

However, in examining the Neuro ORs we further uncovered some of the implications of the fragmented divisional structure described in the analysis of the Main ORs and

[203] We first referred to the European Work Directive in section 8.4.2.1. Succinctly, junior doctors were no longer allowed to work as many as 100 hours a week as before. Instead, they could only work a maximum of 48 hours a week.

Cardiac ORs. With the case of the Neuro ORs having to reschedule cases, these implications were even more pronounced as 25% of their OR physical capacity belonged to the Main ORs which in turn were managed by a different division. We will examine these implications in close detail in the next subsection.

8.6.2.5 Neuro ORs Organization View

The Neuro ORs' local organizational climate was characterized as its staff being generally frustrated and tired (i.e. *worn out*)

The pressure of the NHS' 18 Weeks target together with Hospital ABC's senior leadership and management constantly reminding the Neuro ORs that they were underperforming, is best summarized in the following quote:

> *"we have kind of one of the most extensive waiting lists, and have been outside the realm of the possibility of over 300 patients waiting for neurosurgery, and 10 patients a week put on the schedule for the surgery, so that we can kind of keep our heads above water with all sorts of acrobatics and extra lists and extending lists and Saturday lists, but we are slowly losing the battle because the clinical loads just keeps on increasing and the flood gates have been kept open and other hospitals are now sending spine patients to us, so we are kind of in the losing end of the 18 week target [...]People are pretty much working flat out and we are losing the battle..."*
>
> Hospital ABC Neuro ORs Anesthesiologist

The staff in the Neuro ORs is said to be working nonstop while trying to make the most use of its ORs in order to decrease the size of its waiting list. Both interviewees felt frustrated with the rate of cancellations, and the neurosurgeon in particular, held responsible Hospital ABC's fragmented divisional structure.[204]

[204] Notably, the fragmented divisional structure emerged as phenomena of interest in all of the previous sub-architectures (i.e. Main ORs, Cardiac ORs, and Administrative Support Services); hence, it prompted further inquiry. Specifically, we found that Hospital ABC had originally created two divisions, which essentially either housed surgery related subspecialties (i.e. performed procedures) or medicine related subspecialties (i.e. treatment and observation based care). Over time, with the advent of medical specialization and with Hospital ABC being able to attain its differentiated clinical excellence status, additional divisions were created so as to make operations more manageable. Specifically, with the increase of specialization, Hospital ABC's senior leadership thought it would be best to create separate independent

"Essentially we are being setup to fail on that by Critical Care. Fantastic! They win all way around!" [Note: interviewee used extremely sarcastic tone in this quote]

Hospital ABC Neuro ORs Surgeon

The Neuro ORs culture was supportive of Hospital ABC's strategic tension and mission

Both interviewees were in general supportive of Hospital ABC's strategic objectives (i.e. serving surrounding community; striving for clinical excellence; teaching) but they argued that the hospital didn't have a care delivery platform capable of efficiently handling the inherent strategic tension. Specifically, every patient, whether requiring simple or complex care, was undergoing exactly the same steps. However, the requirements of each patient population are fundamentally different. Simple cases generally require less OR time, less surgical kit, less scheduling (e.g. no need for an orthopedic surgeon consult), less resources (e.g. faster patient recovery; smaller OR teams; etc). Conversely, complex cases not only require more of each of the categories just mentioned, but are also more unpredictable (e.g. unknown complications become visible during the procedure) and require a greater amount of ancillary tests. As such, the interviewees considered Hospital ABC's platform overly wasteful and suggested that two fundamentally different structures should be in place. One structure would handle routine care, while another structure would be targeted at the most complex cases. As for junior doctors, they would be rotated across both structures as they progressed in their training. All in all, both neurosurgery clinicians felt that it was unrealistic to successfully meet the 18 Weeks target and at the same time satisfy all of senior leadership's strategic objectives.

Hospital ABC had a fragmented divisional structure and experienced a considerable organizational divide amongst senior leadership, management, and clinicians

The separation amongst Hospital ABC's organizational structures was strongly

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divisions, and to that effect created divisions pertaining to specific human organs (e.g. liver; cardiac; brain; women's health; etc). However, not only was there redundancy at a support function level (e.g. each division had its own human resources, procurement, admissions, etc) but also in terms of medical activities (e.g. each division would have its own department of surgery which didn't share information, equipment, or staff with other surgery departments in other divisions). Additionally, each division had its own management layer, which was responsible for allocating resources to its own departments, and its own nursing and physician layers. Over time, Hospital ABC begun experimenting with sharing resources across divisions (e.g. the SCC division managed all the anesthesiologists used in all divisions). However, the vast majority of resources remained dedicated to each division and prevented easy sharing amongst them.

emphasized by the neurosurgery clinicians and they associated it vehemently with the Neuro ORs poor performance.

To begin with they argued that senior leadership didn't encourage clinical involvement, and clinicians had to face the choice of either practicing medicine or becoming *one of them*. Also, in the little exposure they had had to management roles, they found these to be overly time consuming which made clinical leadership difficult to sustain.

> *"There is a management led management structure at [Hospital ABC] which hasn't encouraged clinical involvement."*
>
> Hospital ABC Neuro ORs Surgeon

Our analysis of the Main ORs and the Cardiac ORs had already identified the issue of Hospital ABC's fragmented divisional structure which allowed for, and motivated, compartmentalization that led to suboptimization, and ultimately compromised effectiveness as a whole. In analyzing the Neuro ORs, such dysfunctionalities were even more pronounced given that they had to physically share OR space with the Main ORs. Specifically, neurosurgery's overall performance was poor, however, when using space in the Main ORs, its productivity was only 70% of what it was capable of doing in the Neuro ORs space. Indeed one element of waste was the inability of centralizing equipment and having to move between floors, etc. However, there were deeper issues than mere logistical complexity.

First, unlike the Cardiac ORs anesthesiologists which are dedicated to the Cardiac ORs due to their level of specialization, the neurosurgery anesthesiologists are shared with other specialties that function exclusively within the Main ORs (e.g. orthopedics, pediatrics, etc). All of the anesthesiologists are managed by the SCC division (i.e. none of them belongs to the division of Cardiac and Neurosciences). However, the neurosurgeon argued that whereas the Cardiac ORs was able to build a sense of loyalty, including its anesthesiologists, the Neuro ORs weren't able to do so and that its anesthesiologists were instead loyal to the Main ORs.

Second, given that the Neuro ORs were managed through a different division, the lead neurosurgeon felt that they were competing against them. Specifically, the Neurosciences division had to pay the SCC division for each and every OR slot it reserved, regardless of whether it was used or not. For instance, given the difficulty in rescheduling procedures, it was common for cancelled procedures to cause an OR slot to go unused. However, the Neuroscience division would still be fully charged for the slot, and the SCC would not only make a profit but also try to reassign the slot and associated staff to another of its Main ORs procedures. Ultimately, the neurosurgeon felt that the SCC division management along with its anesthesiologists, had a vested interest for the Neuro ORs to cancel procedures. Similarly, the Main ORs' nursing staff supporting neurosurgery lists were said to be encouraged not to accept working on overrunning operating lists.

> *"At the moment the neuro theaters management is through critical care, who in many ways are competitors to us, if we regard it very bluntly, if a neuro theater is empty it still gets paid for... if we have a list scheduled that does not get used, Critical Care make a profit out of it, we make a loss out of it, so there will always be within the whole fabric of the system a tension there."*
>
> Hospital ABC Neuro ORs Surgeon

Finally, both interviewees also spoke of a divide amongst Hospital ABC's different specialties. One type was *understandable* given that both orthopedics and general surgery were housed under the SCC division (which they argued was competing against the Neurosciences division). However, it was surprising to learn that neuroscience, neurology, and neurosurgery, all of which housed under the same Neurosciences division, were also described as distant from one another and only shared patient information over fax. Finally, interviewees observed that senior leadership had done away with "consultant sitting rooms" as these were deemed elitist. However, the adverse effect was that physicians and surgeons had even less opportunity to engage in cross-specialty discussions.

> *"there is no discussion across specialties, and that is undoubtedly a big problem in this hospital. [...] when neurosurgery gets referred a case from general medicine for an*

opinion we don't really want to go down there, and we don't talk to their physicians, they don't talk to us, and we don't care, and that is the mentality that is setup by not having any cross specialty talk. You have the same difficulty within neuroscience, neurology, and neurosurgery, almost the same specialty really becomes pulled apart mostly because we operate on different days, there is no discussion, so we end up with curt referrals by fax and it doesn't work well."

Hospital ABC Neuro ORs Surgeon

The Neuro ORs exercised limited control and influence beyond their service unit boundary

As with the Main ORs, the Neuro ORs found operating list scheduling adjustments complex and human resource intensive because of the number of organizational structures and the various levels within them. Therefore, not only the Neuro ORs feel that another division is competing against them, but they are also faced with their limited ability to control and influence stakeholders beyond their service unit boundary. For instance, late retrieval of patients from inpatient service units is said to be one of the key reasons for neurosurgery cancellations. However, in order to resolve an interface issue between the porters and the Holding Bay, the neurosurgeon would have to go up his management structure, across to another structure, and then finally down again. To further complicate things, the Neuro ORs didn't have their own coordinator, and had to rely instead on the Main ORs Coordinator to manage their patient flow to and from the inpatient service units. The lack of a dedicated coordinator was thought to be yet another opportunity for the SCC division to pressure the Neuro ORs.

Ultimately, the neurosurgeon felt that its divisional manager should be more present in the field in order to protect their interests and pressure both the inpatient service units and the Main ORs to be more supportive of Neuro ORs' operations, or at least stop working against them.

Neuro ORs local organizational culture was inconsistent amongst different roles

We have already described the existing organizational divide between the Neuro ORs and both senior leadership and management. An analysis within the Neuro ORs identified

specific tendencies in the relationships amongst various stakeholder roles:

- Overall the Neuro ORs felt pinned by the SCC division. At the very least, both the neurosurgeon and the anesthesiologist felt that the Main ORs weren't supporting them adequately with patient flow and they felt frustrated with the sheer number of procedure cancellations. Additionally, they both thought poorly of the Main ORs Coordinator and her ability/interest in supporting their patient flow.
- The Neurosciences division had a clear preference for its autonomy within its dedicated Neuro ORs, and said they weren't enthusiastic about the *opportunity* for sharing space in the Main OR's in order to curb their long waiting lists. However, there had been recent talk about building an additional OR dedicated for Neurosciences, and that in turn was said to have been very well received by neurosurgeons.
- The interviewees represented different roles and spoke differently of each other. The neurosurgeon generally regarded anesthesiologists to have vested interests as they were associated with the SCC division. The anesthesiologist was more positive in his assessment and considered that Hospital ABC provided a level playing field (i.e. similar salary and hierarchical status) between anesthesiologists and surgeons, which was conducive to productive work relationships.
- Both surgeon and anesthesiologist appreciated the efforts of the nursing staff. They felt that the nurses most consistently staffed to the Neuro ORs were indeed *on the same side* as them[205] and would be supportive of the need to overrun operating lists.

> *"An anesthesiologist would have within their system a hidden vested interest in saying 'I am not going to fill the list' because their management structure actually rewards that somehow. [...] So in the background, despite what I said about working reasonably well together as a small group, actually within the management structure we are competitors and that is a fundamental problem in the background all the time"*
>
> Hospital ABC Neuro ORs Surgeon
>
> *"[There are] very good relationship between surgeons and theater staff. [...] There is*

[205] Whenever the Neurosciences division used an OR from the Main ORs, it would be fully staffed with Main ORs nurses, and these were thought to be on the Main ORs *side* as opposed to theirs.

good cooperation and flexibility amongst this group of people that concentrate about just doing neuro and the benefits of having that relatively small group of people working on the same side, works well"

Hospital ABC Neuro ORs Surgeon

Team familiarity was said to help build culture and performance

As with the case of the Main ORs and the Cardiac ORs, both neurosurgery clinicians valued the ability to foster team familiarity in their service unit. A stable team helps build a likeminded culture and also drives efficiency and quality of care.

"people are familiar with the system, people are familiar with the cases, they have people who always work in the sessions, they get to know the surgeon, the surgeon knows you, there is interaction outside, there is a confidence that is built, there is knowledge of ability and inability of each party, you know, things that make the system work better."

Hospital ABC Neuro ORs Anesthesiologist

However, whereas the Main ORs also observed that there was insufficient operational flexibility because of the fixed staff scheduling (i.e. staff are assigned to specific ORs on specific days), the neurosurgery clinicians only spoke positively of staff scheduling practices. Nonetheless, the data indicates that the Neuro ORs were struggling with cancellations and were largely unsuccessful in making the necessary operating list adjustments in order to avoid losing the OR time slot. Hence, one could argue that the Main ORs and the Neuro ORs were experiencing the same tension between team stability and operational flexibility. Conversely, the Cardiac ORs had a very low cancellation rate, kept stable teams, and had a high throughput rate.

The Neuro ORs staff had multiple individual incentives but generally considered them to be insufficient. Additionally, they regarded NHS' career progression opportunities as limited, and it salary structure as constrained

In describing what drove them to perform at Hospital ABC, both interviewees were largely consistent with what the clinicians in the other OR service units. They valued Hospital ABC's brand and upheld the importance of caring for the surrounding

community. However, as previously noted, they observed that Hospital ABC's care delivery platform wasn't adequately designed, as it considered every patient to be a complex patient, and such introduced considerable waste into the system, which in turn affected their desire to practice in an efficient environment.

Additionally, they expressed a similar interest in instituting procedure volume based incentives in order to motivate clinicians to contribute towards a higher throughput. Both interviewees felt that not everyone was working as hard towards helping the Neuro ORs meet its 18 Weeks target. The neurosurgeon observed that he had visited a leading hospital in the US and that he was convinced that a volume based incentive was a useful mechanism to define a *clear unit of currency*.

> *"Operations was very clearly [the US hospital's] unit of currency, the more operations the more money, and everything was designed around that. I think we struggle slightly in what our unit of currency is."*
>
> Hospital ABC Neuro ORs Surgeon

Furthermore, as with the case of the Cardiac ORs, they observed that there were limited career development opportunities at Hospital ABC and the NHS in general, and specially so once an individual reached the highest pay grade in his or her role. Moreover, the lack of career opportunities together with a fixed salary model, were associated with less commitment towards patient throughput, or perhaps Hospital ABC in general.

> *"There is very limited career development and there is no creativity and learning that you can move on to a higher level... there is no kind of long range vision... people bump their head into the ceiling."*
>
> Hospital ABC Neuro ORs Anesthesiologist

8.6.2.6 Neuro ORs Knowledge View

In previous subsections we have noted phenomena pertaining to the Neuro ORs Knowledge View. The following are key insights:

Hospital ABC as a whole isn't a learning organization

In examining the previous Neuro ORs subsections we further substantiate our assessment that Hospital ABC, as a whole, isn't a learning organization. The absent *way of doing things* at Hospital ABC, stemming from its fragmented divisional structure, was particularly negative for the Neuro ORs[206]. The Neurosciences division struggled with high cancellation rates both in its dedicated ORs and in the one shared with the Main ORs. The lead neurosurgeon argued that the divisional structure fostered competition and that high cancellations were the direct result of said competition. Clearly, said behaviors aren't in line with those of a learning organization which would have otherwise engaged in joint problem solving activities that might have been deployed locally, but within the context of the overall enterprise. Finally, the Neuro ORs provided further insight into the constraints of limited career development opportunities within NHS' band system, which compounded the effect of lack of motivation due to fixed salaries.

The Neuro ORs hadn't instituted a coordinator of their own, and instead relied on the Main ORs Coordinator

Whereas the Cardiac ORs had experienced clinical coordinators which were strongly associated with the service unit's higher performance, the Neuro ORs had to share the same Main ORs Coordinator which was once again deemed ineffective. When analyzing Main ORs data it was clear that clinicians considered their coordinator inadequate because of her lack of training and inability to sway senior physicians towards facilitating flexibility and increasing patient throughput. In the case of the Neuro ORs, the Main ORs coordinator's incentives were put in question, as she was regarded as a mechanism to force procedure cancellations for the Neuro ORs. However, considering both data sets one could argue that the Main ORs coordinator was faced with several system architecture dysfunctionalities which simply kept her from assisting the Neuro ORs. Nonetheless, the fact still remains that the Neuro ORs didn't have in place a knowledgeable clinical coordinator capable of assisting in all matters related to patient flow and instituting and enforcing standard practices in their Neuro ORs.

[206] Notably, a way of doing things doesn't in itself imply that it is better since the wrong things may constitute the "way of doing things".

The Neuro ORs didn't exhibit learning organization behavior

Whereas the Cardiac ORs had instituted practices targeted at influencing and improving flow beyond their boundaries of control, the Neuro ORs hadn't done anything to a similar effect. However, the neurosurgery clinicians had detected several dysfunctionalities and admitted that they lacked a full picture. Arguably, they could have presented evidence that they had tried to address these limitations. Instead, they were seemingly content on blaming the SCC division for all of their performance issues. However, even within their own division they seemed to be fragmented, as similar specialties meant to provide team based multispecialty care, did so over fax.

The Neuro ORs experienced considerable knowledge training constraints

As with the Main ORs, the Neuro ORs had a clear concern towards their ability to adequately train physicians in the presence of restrictive European Work Directives. They felt that trainees weren't clocking as many training hours as necessary and would either have to face even longer training programs or potentially endanger the delivery of care. Similarly, amid the pressure of 18 Weeks the neurosurgeon admitted that their processes within the OR weren't as robust as they should be. He admitted that timeout (an evidenced based medicine guideline) weren't always carried out and that every year they would have at least one serious case of operating the wrong side of the head. Furthermore, financial incentives were once again mentioned, and that there wasn't an incentive to even start a journal club[207], let alone a grand rounds lecture. However, interviewees also suggested that management was more interested in having everyone always working in the ORs, rather than spending time with such knowledge opportunities.

> *"As you see the European Work Directives coming in... the amount of responsibility being pealed away... the amount of hours being pealed away... the night call being pealed away... the concern of the faculty here is that they are being deskilled or in some sense detrained... There is a general feeling that they are getting fewer hours on the ground and that when they get into the positions of responsibility they won't quite have*

[207] Journal clubs are a common practice in US academic medical centers. In effect, both medical residents and physician attendings organize themselves into both separate and shared groups where they jointly collect and analyze recent journal publications so as to keep up to date with the developments in their given specialty.

the same degree of experience when they get out the other end. [...] Keep everybody working, keep everybody in the OR, and I think that is not a good thing in medicine."

Hospital ABC Neuro ORs Anesthesiologist

"I think we could work better with things like avoiding wrong side surgery or operating on the wrong side of the head. We have a system which is not very robust to deal with that. We have a case like that at least once a year."

Hospital ABC Neuro ORs Surgeon

8.6.2.7 Neuro ORs Information View

In previous subsections we have noted phenomena pertaining to the Neuro ORs Information View. From an infrastructure capability standpoint these were similar to those that were previously described in the Main ORs (see section 8.4.2.7). Specifically, the existence of paper-based patient records, the absence of an electronic workflow information, etc, meant the prevalence of paper-based information systems, and the need for extensive human resource intervention (e.g. pushing paper, using the phone, etc).

The lack of information flow in the Neuro ORs was further exacerbated by their reliance on the Main ORs Coordinator to support their operations. However, as previously mentioned, they also had issues in sharing information across specialties within their own division (i.e. they shared patient information over fax).

Furthermore, the interviewees reiterated the issues stemming from constrained staffing schedules and absent post operating notes, which ultimately compromised information flow, patient throughput, and patient experience. The following quote captures particularly well the clinicians frustration with their information systems capabilities:

"The key is the availability of the appropriate information at the bedside. That operation note exists and is filed in a set of notes like this [picks up big paper medical record]... there they are, patient came back from theater, volume one, so probably the operation note is in volume two which is somewhere else [inquisitive voice]. But lets find an

operation note here... hopefully... there it is... ah! Nothing written on it!!!!"

Hospital ABC Neuro ORs Surgeon

8.6.2.8 Neuro ORs and analysis summary

In this section we presented our analysis of the Neuro ORs. A total of two interviews were conducted with Neuro ORs staff, namely with the lead surgeon and the lead anesthesiologist, as well as evidence collected from observing their operations. Figure 8-10 is the overview of Hospital ABC's Neuro ORs sub-architecture characterization presented earlier[208] and pertains to the analysis of the previous subsections. The coloring of the elements in the figure is a visualization technique to readily compare this sub-architecture with that of the Main ORs previously discussed in section 8.4.3. Specifically, black denotes no change from the Main ORs sub-architecture; red denotes new elements; orange denotes previous elements which have changed in some regard. Notably, all of the new elements presented have already been characterized in the context of the Cardiac ORs. Furthermore, in the descriptions that follow we also directly make comparative references to the Main ORs sub-architecture, the Cardiac ORs sub-architecture, and the Administrative Support Services sub-architecture[209].

The characterization of the Neuro ORs sub-architecture concerns both local enterprise architecture characteristics (i.e. pertaining specifically to the Neuro ORs) as well as enterprise level (i.e. pertaining to Hospital ABC as a whole), and reflects our enriched understanding of hospital enterprise architecture (i.e. leverages our enriched version of the NREAF discussed at the end of Chapter 7[210]). The circle placement of the EA Views is meant to illustrate that they are interconnected.

The Neuro ORs sub-architecture characterization is almost identical to that of the Main ORs. So much so, that the Strategy, Information, and Process EA Views were unchanged. Hence, the summary analysis previously provided for the Main ORs (i.e. EA View

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[208] See section 8.6.2

[209] For additional detail on each of the Main ORs elements referred to, please see section 8.4.3. Similarly, for the Cardiac ORs elements referred to, please see section 8.6.1.8. Finally, for the Administrative Support Services elements referred to, please see section 8.5.8.

[210] See section 7.7.2.

individual and interaction descriptions) is also applicable to that of the Neuro ORs (see 8.4.3). Notably, the new elements identified emerged from our targeted probing that reflected our findings from the Administrative Support Services and the Cardiac ORs (i.e. there aren't new elements that emerged exclusively from the Neuro ORs), and are equally relevant to our previous characterization of the Main ORs.

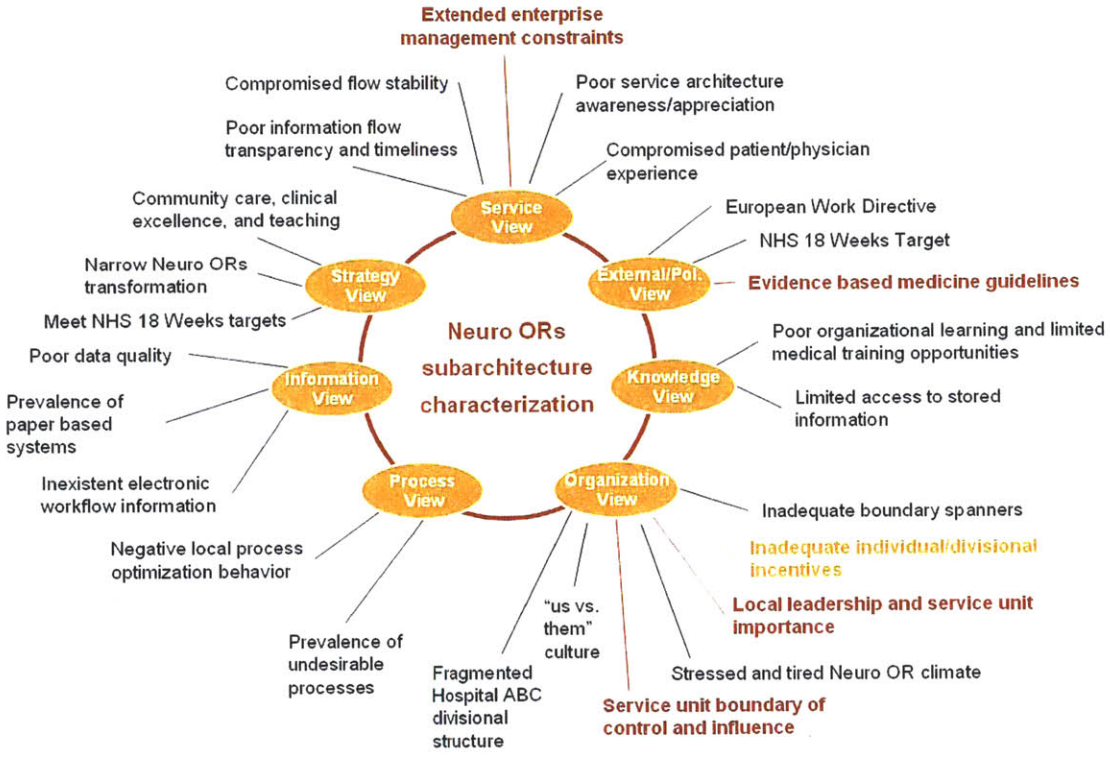

Figure 8-10: Hospital ABC Neuro ORs sub-architecture characterization

However, new phenomena did indeed emerge whilst examining the Neuro ORs and their relationship with the Main ORs and the SCC division in general. Specifically, we established that not only there were limitations pertaining to individual incentives (i.e. as with the Main ORs and Cardiac ORs) but also with those tied to the fragmented divisional structures. Moreover, there was potential for Main ORs vested interests to contribute to the Neuro ORs cancellation rate whenever it used an OR slot in the Main ORs. However, the fact still remained that the Neuro ORs performance in their dedicated ORs was still worse than the Main ORs and Cardiac ORs.

All in all, we theoretically sampled the Neuro ORs for their lowest performance, and similar to the analysis of the Main ORs, our enriched understanding of Hospital ABC's enterprise architecture, and in particular that of its Neuro OR's sub-architecture, led us to determine that the service unit's throughput issues neither resided only at a process level nor only within its boundaries. As such, senior leadership's envisioned investment plan in building an additional Neuro OR, and its continued narrow improvement plans, will not address the core enterprise architecture issues that prevent it from delivering value efficiently and effectively.

Given the Neuro ORs similarity to the Main ORs, comparing them to the Cardiac ORs generates a similar output as the previous comparison between Cardiac ORs and Main ORs (see section 8.6.1.8). **This outcome is further evidence of our previous finding that an enriched understanding of hospital enterprise architecture can inform decisions that ultimately contribute to higher performance**. Specifically, both the Cardiac ORs and Neuro ORs belonged to the same division (i.e. Cardiac and Neurosciences), had dedicated surgeons who earned the same compensation, interacted with the same inpatient service units and ancillary services, and had a similar plant scale. Indeed there were small differences pertaining to Neuro ORs anesthesiologists not being exclusive to their operations (i.e. the Cardiac ORs had exclusive anesthesiologists)[211], and also the fact that the Neuro ORs shared one OR with the Main ORs (i.e. the Cardiac ORs didn't use OR slots in the Main ORs). However, whereas the Cardiac ORs' local leadership made decisions that affected their local operations, as well as their interface with other service units, the Neuro ORs could have arguably implemented similar decisions (e.g. hiring a clinical coordinator, standard processes, aligned schedules, boundary spanners, process measurement, etc). Instead, the Neuro ORs didn't even align themselves across related subspecialties within their own division (i.e. Neurology,

[211] Although the Neuro ORs anesthesiologists were shared with the Main ORs procedures, a subsequent targeted probing interview with the Anesthetic Delivery Manager revealed that the Neuro ORs anesthesiologists, although shared, remained the same. Furthermore, although the Cardiac ORs did indeed have exclusive anesthesiologists, these belonged nonetheless to the SCC division, as were the anesthesiologists servicing the Neuro ORs. Finally, given the fixed salary model inherent in the NHS, the anesthesiologists would earn the same regardless of their procedure volume and whether they worked in the Neuro ORs or Cardiac ORs. Therefore, one could argue that the Neuro ORs complaint about nonexclusive anesthesiologists is irrelevant when comparing the Neuro ORs to the Cardiac ORs.

Neurosurgery, and Neurosciences) and elected to reinforce the existing fragmented divisional structure and "Us vs. Them" culture at Hospital ABC (i.e. such was the behavior of the Main ORs as well). Moreover, the Cardiac ORs' local leadership had both an enriched understanding of hospital enterprise architecture, and a predisposition to act upon it to improve performance, while the Neuro ORs exhibited neither of these.

8.7 Hospital ABC Enterprise Architecture

At Hospital ABC's senior leadership request, our research began with the characterization of the Main ORs, and we gradually increased its scope and added several embedded units of analysis as new insights emerged from the data. Figure 8-11 is a visual summary of the four sub-architectures that were studied in detail[212].

The study of each sub-architecture had a different service unit as a focal point, but the analysis not only studied their internal characteristics and interdependencies with other service units, but also addressed common enterprise level elements (e.g. senior leadership, information infrastructure, NHS pressure, etc) and leveraged internal strategy and operations documents. As such, in Figure 8-12 we characterize Hospital ABC's overall enterprise architecture. Notably, in our following EA View descriptions we first focus on the predominant characteristics throughout the enterprise, and subsequently briefly discuss EA View interactions, and the existence of multiple internal architectural configurations within Hospital ABC.

[212] For further detail please refer to sections 8.4.3., 8.5.8., 8.6.1.8., and 8.6.2.8.

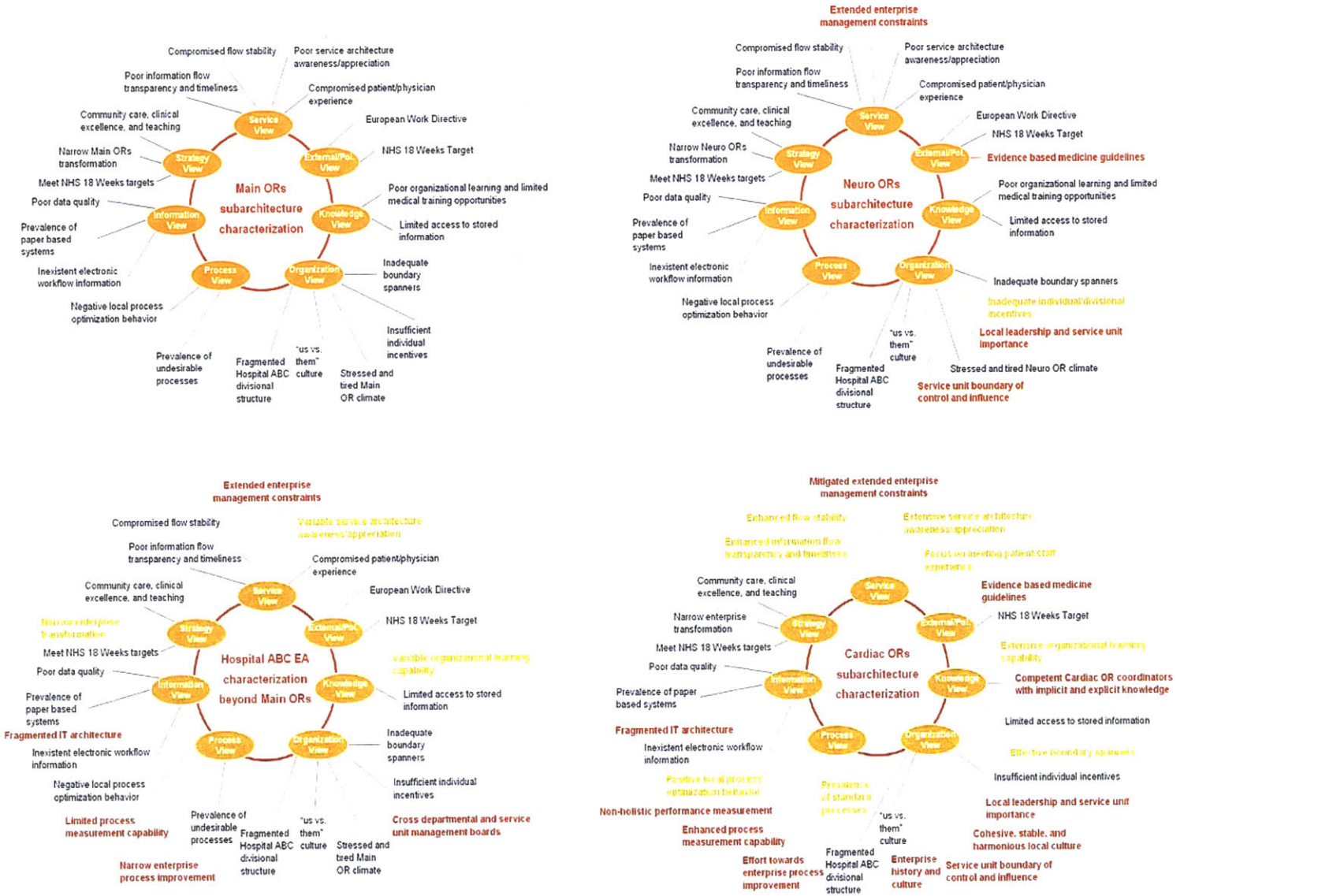

Figure 8-11: Overview of Hospital ABC's sub-architecture analysis summaries

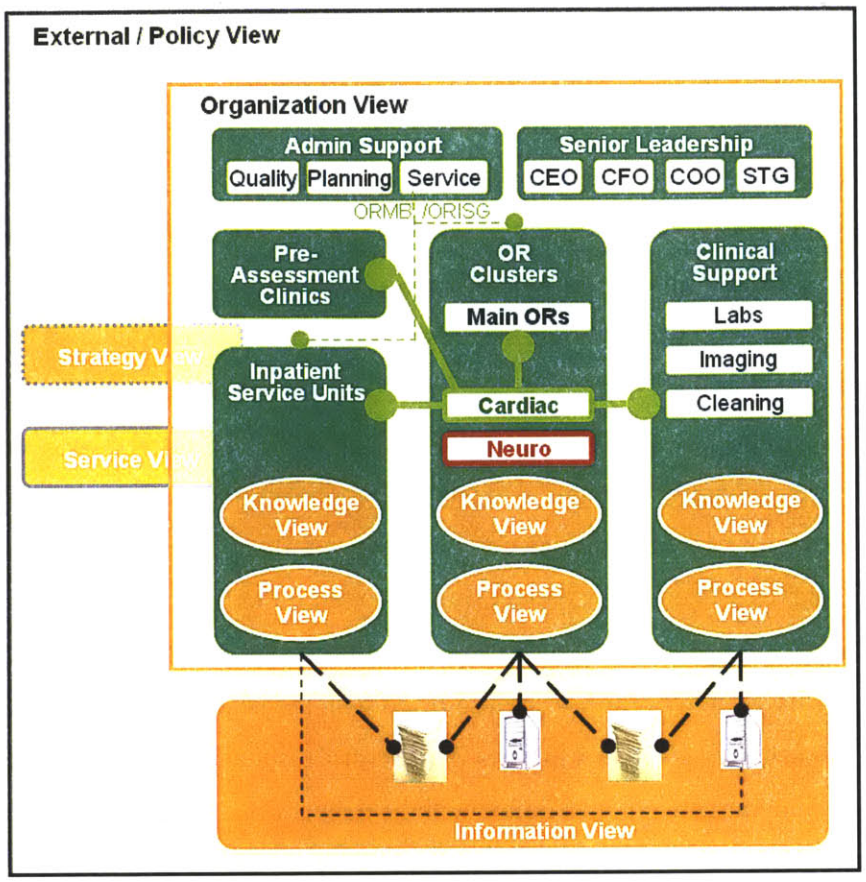

Figure 8-12: Hospital ABC Enterprise Architecture

8.7.1 Hospital ABC EA View Analysis

Hospital ABC External/Policy EA View

Hospital ABC's external and policy environment was consistently described in terms of the NHS' 18 Weeks pressure (i.e. elective surgery timeframe forced upon hospitals across the NHS), the constraining European Work Directive (i.e. a recent labor law change only allowed junior doctors to work 48 hours a week, as opposed to the previous non-restrictive work hours), and evidence based medicine guidelines. Notably, interviewees in general were dedicated in treating patients with the best care possible, however they didn't regard them as a source of external pressure as such. Overall, the external and policy environment strongly influenced Hospital ABC as evidenced in the strategic objectives set by senior leadership, and existing constraints on operations (e.g. processes and organization).

Hospital ABC Strategy EA View

Hospital ABC's enterprise strategy elements were consistently described in terms of providing high quality care to the surrounding community, pursuing clinical excellence with national and international recognition, and sustaining its leading training programs. Notably, Hospital ABC was a leading hospital in the UK, but the NHS' 18 Weeks policy had left it struggling to find a way to shorten its elective wait lists and avoid the potential penalties of doing otherwise. Hence, meeting the NHS' 18 Weeks target had become the strategic imperative for Hospital ABC. However, such an imperative exacerbated the strategic tension amongst its strategy elements. Specifically, Hospital ABC's enterprise architecture was generally configured to support its pursuit of clinical excellence. However, the result was that every patient, whether simple or complex, was treated with the same resources as a complex patient (i.e. it is wasteful to treat a simple patient as if (s)he were a complex patient, but the delivery platform was geared towards complex cases only). This setup was further compromised with the need to increase patient throughput and shorten elective wait lists. Moreover, Hospital ABC's strategy elements and strategic imperative were misaligned with its delivery platform. Finally, the investments and initiatives implemented by senior leadership had proven to be narrow and inadequately executed. Examples we discussed included narrow investments in adding capacity in specific areas within different service units, but failing to consider the different value streams as a whole, as well as other important elements (e.g. staffing, incentives, etc). Similarly, although a potentially useful resource was created via the internal Lean Team, its charter was set at process level and targeted at individual service units (e.g. lean initiatives targeted within the Main ORs had generated minimum results). Ultimately, it is important to note that Hospital ABC's characterization from a Strategy EA View necessarily reflects the effect of EA View interactions. For instance, senior leaders are in themselves part of the Organization EA View, and the predominant fragmented divisional structure and inherent "Us vs. them" culture, contributed to strategy decisions that demonstrated poor service architecture awareness/appreciation.

Hospital ABC Information EA View

Hospital ABC had limited information architecture capability as evidenced in its fragmented information systems characterized by a prevalence of paper and non-integrated IT solutions, which contributed to several data quality issues, and didn't allow for an end-to-end workflow analysis. Additionally, information was not only fragmented in terms of type (e.g. electronic vs. paper-based) but also in terms of function (e.g. vacation book ledgers; admissions book ledgers; staffing excel sheets; etc). Hence, even within each division, finding information proved to be a cumbersome and human resource heavy task. All in all, extensive use of alternative modes of information sharing were required that not only were error prone and introduced system delays, but also required extensive human resource dedication and ultimately demanded more of individuals both physically and mentally.

Hospital ABC Organization EA View

Hospital ABC was an organization centric enterprise as evidenced in its dominant characterization as having a fragmented divisional structure. Examples we discussed included the arm's length relationships between senior leadership and senior clinicians. Similarly, senior managers didn't feel supported by senior leaders in addressing and enforcing necessary unpopular decisions that impacted senior clinicians. Hence, clinicians and managers didn't have integrated relationships. Finally, evidence of "Us vs. them" was also found within the different clinician hierarchies (e.g. nurses and senior surgeons). Other examples of structural fragmentation concerned the replication of functions across different divisions (i.e. each division had its own procurement, scheduling, etc) and the use of incentives that reinforced *silo* thinking (e.g. incentives were distributed independently to each division, as opposed to distributing them across value streams). As a result, Hospital ABC was described as "*not having a way of doing things*". Notably, having a way of doing things doesn't necessarily entail a better outcome either, as the way of doing things can be the wrong way by definition.

Furthermore, the additional pressure to meet the NHS 18 Weeks target, together with Hospital ABC's enterprise architecture dysfunctionalities, created an organizational

climate of frustration and stress amongst clinicians and managers in the various divisions and service units.

Further examination of Hospital ABC's fragmented divisional structure revealed the importance of understanding each service unit's boundary of control and influence, as well as the strength of their local leadership and inherent service unit importance to the overall enterprise. Different service units had different levels of leadership strength, a different culture (i.e. ranging from cohesive to "Us vs. them"), and different organizational arrangements (e.g. boundary spanners, rounding/surgery teams, etc). Finally, there was consistency across service units in terms of managers' inability establish incentives based on meritocracy as opposed to seniority. Moreover, existing NHS labor laws made it difficult to retain the best people or to encourage those with room for improvement.

Hospital ABC Process EA View

Hospital ABC's process architecture was predominantly characterized as having undesirable processes, negative local process optimization behaviors, limited process measurement capability, and narrow enterprise process improvements. Examples we discussed of undesirable processes included the last minute reshuffling of operating lists, the existence of inconsistent process descriptions, stakeholders varying process requirements, etc. As for negative local process optimization behaviors, examples we discussed included service units calling for patients too early, poaching of surgical kits, creating unreasonable operating lists, transferring unready patients, etc. In term of process measurement capability we established that the limited information architecture capability significantly hindered performance measurement and operations management (e.g. use of guesstimates to evaluate operating lists, predominance of lagging indicators such number of procedure cancellations, etc). Furthermore, the information that was indeed tracked by Hospital ABC, was neither reviewed regularly (i.e. only monthly) nor shared across different stakeholders (i.e. senior leadership didn't give senior clinicians financial data access). Finally, as previously noted in the Strategy EA View description, the internal Lean Team was chartered to pursue initiatives at a process level and targeted

at individual service units. Furthermore, the existence of local process optimization behaviors and non-standard processes, together with the previously described fragmented divisional structure, contributed to improvements being predominantly narrow in scope and failed to address Hospital ABC's overall service architecture.

Hospital ABC Service EA View

Hospital ABC's service architecture was predominantly characterized as having poor information flow transparency and timeliness, having compromised flow stability, having extended enterprise constraints, and ultimately being unable to adequately deliver on either patient or employee experience, as evidenced in the long wait lists and frustrated service unit staff. Hospital ABC's dominant extended enterprise constraint were the pre-assessment clinics, as their independent scheduling generally contributed to inappropriately long waiting lists which in turn allowed for patient symptoms to change, and potentially force a procedure cancellation. Finally, there was variable service architecture awareness/appreciation across Hospital ABC. As noted, senior leadership had limited awareness, as did several clinicians and managers who instituted local practices without concern towards potential negative effects upstream or downstream. However, there were also stakeholders who did indeed have an extended service architecture awareness/appreciation as evidenced by their decisions.

Hospital ABC Knowledge EA View

Hospital ABC as a whole isn't a learning organization. However, there was evidence of extensive organizational learning practices at a sub-architecture level (i.e. Cardiac ORs), and efforts were underway to replicate said practices to Hospital ABC at large (i.e. cross departmental and service unit management boards). Notably, Hospital ABC as a whole evidenced predominantly non-learning organization behavior.

As noted already, the fragmented divisional structure of Hospital ABC prevents it from defining its *way of doing things*, and instead each division independently strives towards meeting its own bottom line, without sharing information with the remaining divisions, and disregarding potential impacts elsewhere in the service architecture. Similarly,

divisions may be faced with a similar problem or objective, but they fail to share their learning, hence often times spending valuable resources reinventing the wheel. Also, in general, divisions were unable to pinpoint the outcomes of their changes given that several parts could be changing at any given moment without their knowledge. Furthermore, those initiatives that were meant to be enterprise wide seldom reached more than two or three departments, as senior leadership weren't active sponsors beyond the initial broadcasting email. Also, leadership sponsored improvement initiatives are associated with putting out fires inside specific divisions, rather than accomplishing an enterprise wide result. Finally, senior leadership and management elected to keep financial information from clinicians who had repeatedly asked for it in the past. Instead, clinicians feel pressured by management with operational metrics (i.e. number of procedures). Moreover, information isn't shared across enterprise levels and performance isn't examined holistically, even though its information content may exist somewhere inside Hospital ABC.

8.7.2 Hospital ABC EA View Interaction Analysis

In chapter 3 we clarified that the meaning of holistic pertains not only to an enlarged number of EA views used a framework but also to an "*understanding of the interactions of the views [which] becomes of increased importance*" (Rhodes and Nightingale 2008). As noted before, this research adopted an enterprise diagnostic mindset and held no pre-conceived notion of organizational element interactions including strength and direction. Such an approach reflects the described nascent phase of EA theoretical development and allowed for the iterative improvement of our understanding and characterization of each of the EA views both individually and holistically while comparing and contrasting empirical results within and across cases.

Notably, hundreds of EA View interaction instances were documented over the course of our analysis, as evident in the detailed descriptions for each of Hospital ABC's sub-architectures. For instance, already in our descriptions in the previous subsection we highlighted the effects of some EA View interactions. The dominant EA View

interactions that emerged from the exploratory case of Hospital ABC were previously highlighted in sections 8.4.3., 8.5.8., 8.6.1.8., and 8.6.2.8.

8.7.3 Hospital ABC multiple internal architectural configurations

In our exploratory research of Hospital ABC we gradually theoretically sampled several service units and characterized their sub-architecture both in terms of local characteristics (i.e. pertaining specifically to the service unit), as well as enterprise level (i.e. pertaining to Hospital ABC as a whole), whilst leveraging our enriched understanding of hospital enterprise architecture. In doing so, we determined that the Neuro ORs and Main ORs sub-architectures were almost identical, and both of them had poor performance as measured with both perceptual and objective data. Conversely, we determined that the Cardiac ORs had a significantly different sub-architecture than that of the Main ORs and the Neuro ORs. Furthermore, we established how **the Cardiac ORs had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream**. Finally, we also determined that the Cardiac ORs performance had triggered the creation of cross departmental and service unit management boards (see section 8.5) which were tasked with replicating and facilitating the Cardiac ORs practices to Hospital ABC at large.

8.8 Chapter 8 Summary

In this chapter we presented the second of our two in-depth exploratory studies of leading multispecialty hospitals, as we empirically and theoretically enriched MIT's emerging Nightingale-Rhodes Enterprise Architecture Framework (NREAF), and having replicated Chapter 7's key findings, we conclude that **hospital performance can be improved through an enriched understanding of hospital enterprise architecture**.

We followed our hybrid research design which consisted of qualitative and quantitative data collected from multiple levels of the organization, and assessed multiple dimensions

of performance, using both subjective and objective data. A total of 20 interviews were conducted, recorded, transcribed, and subsequently coded. Several walkthroughs, hosted by various clinical staff members, were made throughout different areas of Hospital ABC, as well as a series of non-participatory observations made at different days of the week and at different times of day. Finally, we used internal documentation such as meeting minutes, email communication, and Hospital ABC's overall scorecard which detailed the performance of each of its service units.

We determined that Hospital ABC's Main ORs were indeed struggling to fully leverage plant capacity. However, rather than it being a matter of simply increasing the productivity in the Main ORs, as initially proposed by senior leadership, we found that several dysfunctionalities also stemmed from the Main ORs interactions with inpatient specialties, inpatient service units, and pre-assessment clinics. Furthermore, we established that Hospital ABC's lean initiatives had only been targeted at a process level and within the Main ORs, which wasn't aligned with lean enterprise principles, and had consequently only been able to derive small and short lived efficiency gains.

A close examination of the collected evidence, together with the insights generated from Chapters 2 and 3, and the in-depth exploratory study of Hospital XYZ, gave rise to a total of 24 main categories and 53 subcategories in the enrichment of MIT'S NREAF (i.e. previously described in section 7.7.2). Leveraging our enriched version of the NREAF, the data was reanalyzed, comparing and contrasting findings within and across cases, and ultimately identifying dominant EA View interactions, which further characterized Hospital ABC's EA and the extent to which an enriched understanding of hospital EA was present.

We also replicated our first in-depth study finding that a hospital enterprise may consist of multiple internal architectural configurations, and that these in turn may generate different levels of hospital enterprise performance, where performance is measured as a multidimensional construct, both in terms of dimensions and stakeholders. Specifically, we established that unlike the Neuro ORs and the Main ORs, the Cardiac ORs **had**

gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream.

We also determined that the Cardiac ORs performance had triggered the creation of cross departmental and service unit management boards which were tasked with replicating and facilitating the Cardiac ORs practices to Hospital ABC at large. Hence, although not yet a learning organization, Hospital ABC had began taking its first steps in identifying local organizational learning successes, and attempting not only to replicate them, but also magnify their impact at a wider scale within Hospital ABC. Ultimately, we also replicated our first in-depth study finding that an architectural deficiency in one or more EA Views (e.g. Hospital ABC's limited information architecture capability), may be compensated by the particular configuration of the remaining EA Views.

Finally, we also replicated our finding that integrated multispecialty providers, although regarded in the literature as better able to offer efficient higher quality care, and indeed having been sampled for their strong financial numbers and the multiple awards given by third party organizations, have significant room for improvement, starting with addressing their internal fragmentation at several levels.

In the following, and final, chapter we provide additional specific recommendations to assist hospital leaders in developing and leveraging an enriched understanding of hospital EA while making decisions that are more likely to ultimately improve hospital performance. Additionally, we will review our findings in the broader context of the thesis, summarize our work, and identify avenues for future research.

9. Conclusions, Contributions and Future Work

In this concluding chapter, we will present our findings concisely and tie them back to our research questions. We will also provide specific recommendations to assist hospital leaders in developing and leveraging an enriched understanding of hospital EA while making decisions that are more likely to ultimately improve hospital performance. Finally, we summarize the contributions that this work makes and identify areas where targeted additional work could further illuminate our understanding of enterprise architecture in general and refine our recommendations for hospital enterprises in particular.

9.1 Research Motivation and Research Questions Summary

The overarching motivation for this research was to respond to the National Academy of Engineering and the Institute of Medicine's joint call to promote the application of "*principles, tools, and research from engineering disciplines associated with the analysis, design, and control of complex systems*" (Reid 2005). Lean enterprise principles and an enterprise architecture framework (EAF) are examples of such principles, tools, and research which are under development at MIT and were used in the context of this research.

The US spends 16% of its GDP on health care expenditures, including 30 – 40% of US health care spending which is believed to be wasteful (Reid 2005), and the largest source of expenditure, namely over 30%, is hospital expenditures (Kaiser Foundation 2007). Similarly the United Kingdom's (UK) highest source of healthcare expenditures are hospital services and infrastructure (National Health System 2008). Consequently, the strategies and operations developed and implemented by hospitals have a significant effect on access, quality, and cost of care (Devers, Brewster et al. 2003). However, US health care reform discussions have centered on insurance with standard benefit packages (Cortese and Smoldt 2007) or deep-in-the-weeds debates over technical details (Murray 2010). Some state that once the existing reform debates are over, hospital managers are once again left with the task to design more effective and efficient approaches for

delivering health care (Bohmer 2009). Hence, considering all of these factors, hospitals became the focal unit of analysis in this research, whilst nonetheless including macro-level contextual considerations (e.g. regulation, payment models, etc) and micro level of care delivery (e.g. emergency department, patient wards, etc).

Amid the waste and pressure faced by hospitals, today "*one would be hard pressed to find a hospital in the United States that is not aware of lean principles and considering some sort of lean program*" (Liker and Morgan 2006). However, the approach has been generally flawed as evidenced by popular examples of healthcare literature's reported hospital lean *successes* (Spear 2005; Kim, Spahlinger et al. 2006; Muto, Herbert et al. 2006). These tend to narrowly focus on a few lean tools (e.g. 5S, visual management, etc) at the process level (Bhasin and Burcher 2006) and within individual silos (Allen, Nightingale et al. 2004). Furthermore, under pressure to deliver concrete and actionable operational effectiveness, managers have adopted a *best practice* mentality and sought the advice of business publications and consultants that often ignore the need to have a strategy (Porter 1996) thereby lacking an enterprise architecture perspective. Ultimately, it is important to keep in mind that "*lean is not so much about the individual principles and practices, but [rather] their effective integration and application*" (Nightingale 2002).

Interestingly, Donald Berwick, former chief executive officer of the Institute for Healthcare Improvement (IHI), and current head of the Centers for Medicare and Medicaid (CMS), emphasized that the problem of healthcare redesign becomes increasingly "*harder and the evidence weaker as one moves from the microsystem to the organization*"[213] (Berwick 2002). Additionally, widespread implementation of policies is said to be hindered by the "*heterogeneity of practice settings, with their varying data systems, organizational forms, and degrees of readiness to change*" (Hussey, Eibner et al. 2009). Similarly, "*the evolving organizations are too different to put forward any isolated techniques as uniform resolutions to management problems*" (Evashwick and Weiss

[213] The microsystem refers to the care given at service unit level (e.g. emergency department), whereas the organization is the care provider facility (e.g. hospital) that supports one or more microsystems.

1987). Furthermore, others have acknowledged that hospital specific organizational structures may be relatively efficient and/or more conducive to higher performance, however, in the absence of the necessary in-depth data it has remained impossible to "*gauge impacts of [a hospital's] organization on various dimensions of performance*" (Sloan 1980). Ultimately, a group of health care experts charged with setting a research agenda aimed at improving the US health care system, defined as their highest research priority the understanding and improvement of hospital performance measurement and the identification of key organizational characteristics from high-performing hospitals (Fernandopulle, Ferris et al. 2003).

All in all, in adopting a systems thinking approach we set ourselves to elevate the traditionally narrow hospital definitions of lean health care and explore the broader concepts of lean enterprise principles and enterprise architecture (EA) while enhancing our knowledge of hospitals' socio-technical complexity and underlying performance. Determining what constitutes a Lean Enterprise Architecture, or any theory of the business, may sound deceptively simple but it involves several years of empirical experimentation before reaching a clear, consistent, and valid theory for a given organization (Drucker 1994). Hence, given the nascent phase of development of MIT'S NREAF (Nightingale 2009) another key motivation for this research was to empirically and theoretically enrich the framework.

The following are the four main research questions which were defined and gradually refined in the context of this research whilst addressing the above described research motivation:

- **RQ1**: How is hospital enterprise performance currently measured?
- **RQ2**: How could hospital enterprise performance measurement be improved using lean enterprise principles?
- **RQ3:** Can one create an enriched understanding of hospital enterprise architecture?
- **RQ4:** Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?

9.2 Research Structure and Methodology

9.2.1 Research methodology

In order to answer the four research questions outlined previously, and given the theoretical maturity of the principles and tools proposed to be used in this research, we devised a research design that allowed for continuous and iterative inductive and deductive research cycles. Such an approach had three important characteristics:

- First, a hybrid research design was adopted, comprising the use of both qualitative and quantitative data, and the pursuit of triangulating multiple sources of evidence to verify our collected data, and validate our findings.
- Second, different research questions entailed different data samples. RQ1 and RQ2 specifically pertained to a representative hospital sample made of seven leading hospitals in Massachusetts. RQ3 and RQ4 were addressed with two in-depth case studies, with multiple embedded units of analysis, where both cases were leading large multispecialty hospitals. The two data samples reflected extensive literature reviews of the healthcare literature. Specifically, the derivation of a hospital typology and criteria to select the seven Massachusetts hospitals, and the identification of multispecialty hospitals as the literature's preferred delivery platform model.
- Third, research cycles refined and strengthened our findings. Specifically, the research conducted was non-sequential in nature and our writings on the compare and contrast analysis, within and across hospital cases, reflect how phenomena emerged and underwent refinement. Furthermore, a multidisciplinary review of the literature was conducted not only in the initial phase of this research, but also throughout each in-depth hospital case, as we furthered our understanding of hospital enterprise architecture and enriched MIT's NREAF.

What follows is an overview of the data collection and analysis techniques used while conducting the two in-depth hospital case studies. As we will briefly explain below our research strategy gradually progressed from an exploratory nature towards explanatory[214].

[214] Please refer to Chapter 5 for full detail on the research methods used in this thesis.

In both cases we began by interviewing senior leadership and establishing initial exploratory questions and the desired point of intervention. In Hospital XYZ, senior leadership directed our research to their emergency department (ED), and we preliminary posed the question "*How to speed patient flow in the ED?*". Similarly, in Hospital ABC, senior leadership directed our research to a specific service unit, namely the Main ORs, and we preliminary asked "*How to increase productivity in the Operating Rooms?*". In both cases, senior leadership had singled out a service unit within their organization, and held it primarily accountable for its poor results. Succinctly, the ED was said to be overcrowding with patients, whereas the Main ORs were said to be making poor use of their plant capacity.

The type of preliminary questions asked, and indeed the research questions formulated in this thesis, concerned a contemporary set of events over which we had little or no control. Such characteristics prompted the use of case studies, as recommended by research methods scholars (Eisenhardt 1989; Yin 1994; Edmondson and McManus 2007). In effect, we used multiple sources of evidence (i.e. interviews, observation, documents, and archival records) which were qualitative and quantitative in nature, and allowed for triangulation to verify data validity, as well as to test our proposed explanations for the observed phenomena of interest.

In both cases we verified that the initially studied service units (i.e. ED, Main ORs) were indeed experiencing poor performance as measured by both perceptual (i.e. interviews and observation) and objective data (i.e. archival records and/or internal documents). However, we also established that both service units were being significantly affected by their interactions with stakeholders beyond their unit boundary; hence, our data collection and analysis scope was enlarged in both cases, and began reflecting our use of lean enterprise principles to inform our research (e.g. holistically exploring each hospital).

Once again, and consistent with the recommended research methods previously referenced, we proceeded with collecting and analyzing data from multiple embedded units of analysis within each case study, and applied similar sampling criteria to select

each additional unit. Specifically, we followed a *theoretical sampling*[215] technique (Glaser and Strauss 1967; Charmaz 1983; Eisenhardt 1989; Strauss and Corbin 1990; Edmondson and McManus 2007) and selected both service units and support functions which could provide further evidence towards describing and explaining our preliminary conclusions (i.e. ED and Main ORs shouldn't be held solely accountable for their poor performance). In both cases we collected data from senior leadership, administrative support services (e.g. quality and safety function; process improvement function; planning function; etc), clinical support services (e.g. pharmacy; laboratory; etc), and specific service units. Furthermore, the selection of specific service units was based on *polar case sampling* which is a type of *theoretical sampling* where units of analysis have distinctive characteristics pertaining to the phenomena of interest. In our polar case sampling we were specifically interested in exploring why certain service units had been consistently singled out, in both perceptual and objective data, as high performers or low performers in each hospital case:

- In **Hospital XYZ**, we identified and verified that, for whatever reason (which we later were able to explain), the ED experienced variable performance in its interaction with different inpatient service units. Specifically, we integrated Hospital XYZ's disparate information systems and were able to analyze the patient flow from the ED onto each inpatient service unit. Our analysis found that units of similar size (i.e. number of beds), and of similar characteristics (i.e. centralized patient populations; receiving patients from the ED, ORs, and clinics; housing specialties that significantly contributed to Hospital XYZ's inpatient revenue), either were consistently slow or consistently fast, in admitting ED patients. Hence, we sampled four inpatient service units.
- In **Hospital ABC**, we did not find any consistent characterization of the Main ORs interaction with inpatient service units. Furthermore, we didn't have the benefit of archival record analysis to quantitatively characterize said interactions (i.e. as was done in our Hospital XYZ case). However, we did established that different OR clusters, with similar characteristics (i.e. number of ORs; non-

[215] "*The goal of theoretical sampling is to choose cases which are likely to replicate or extend the emergent theory. In contrast, traditional, within experiment hypothesis-testing studies rely on statistical sampling, in which researchers randomly select the sample from the population*" (Eisenhardt 1989)

centralized inpatient populations; same division), were consistently characterized, both perceptually and objectively (i.e. historic performance scorecards), with different levels of performance. Hence, we sampled the Cardiac ORs and the Neuro ORs.

While collecting and analyzing data from each embedded unit of analysis, in each hospital case, we characterized both local enterprise architecture characteristics (i.e. pertaining specifically to the embedded unit) as well as enterprise level (i.e. pertaining to the respective hospital as a whole), and gradually developed and leveraged our enriched understanding of hospital enterprise architecture (i.e. summarized in RQ3 above). Our findings from each embedded unit of analysis were compared and contrasted within each hospital case study, and subsequently across both hospital case studies. In effect, in triangulating the lessons within and across case studies, a common explanation emerged (Yin 1981) and we developed and tested our answer to RQ4.

In section 9.3 we review our conclusions pertaining to each of this thesis' four research questions. However, we first provide a specific summary of the dissertation immediately below.

9.2.2 Research structure

To provide a specific summary of the dissertation, the chapters' content is summarized below in some detail.

In **Chapters 2-4** we described our extensive longitudinal multidisciplinary literature review which generated and informed each of our research questions. Specifically:

- In **Chapter 2**, we examined the concept of organizational effectiveness, including different theoretical perspectives, as well as how hospital enterprise performance measurement has been characterized in the literature. Furthermore, in line with the literature's recommendation in deriving useful best practices, we theoretically enriched each of LAI's seven lean enterprise principles, which originally were primarily empirically and expert opinion based.

- In **Chapter 3**, we determined that MIT's emerging NREAF is the most complete framework representation of enterprise architecture. In doing so, we established that previous characterizations of the organizational design literature as *stovepipped*, weren't entirely accurate. Similarly, we identified how different frameworks have used different heuristics and theories in studying interactions amongst framework elements (e.g. strategic choice, population ecology, information processing theory, coordination theory, etc). Therefore, we elected to follow an enterprise diagnostic mindset and proposed the use of lean enterprise principles in deriving and interpreting holistic and rich enterprise architecture descriptions (i.e. while studying EA View interactions). Finally, we also explicitly established the need to theoretically and empirically enrich MIT's NREAF so as to identify specific constructs for each of its EA Views, and further support our study of hospital enterprise architectures.
- In **Chapter 4**, we studied the US health care industry in general, and hospitals in particular. In doing so we also identified: a hospital typology to inform our sampling; hospital heterogeneity and the call for in-depth hospital studies; large multispecialty hospitals are the preferred delivery platform model, and hence constituted the sample of our in-depth hospital case studies.

In **Chapter 5**, we described in detail both the rationale and the elements of our research design pertaining to each research question. We explained the construct of methodological fit and how in adopting it as an overarching design criterion for this research, we established the need for a hybrid research design with research cycles. Additionally, we discussed in detail the sampling techniques, for both the seven Massachusetts hospitals and the two in-depth hospital cases, and we enumerated the different sources of evidence for each data sample, as well as the different data analysis techniques used to verify and strengthen our findings (e.g. crossing organizational levels of analysis to improve validity; performing content analysis on interview transcripts; using multiple types of quantitative questionnaires; etc).

Chapter 6 presents our findings and recommendations from studying the seven leading Massachusetts hospitals while addressing RQ1 and RQ2. We compare and contrast our findings with the literature and explicitly identify both consistencies and points of departure. Furthermore, we examine both explicit and implicit performance measurement practices used by the sample hospitals' CEOs, and assess them in terms of their alignment with lean enterprise principles. Finally, grounded in our empirical findings and extensive literature review, we make five specific recommendations as to how hospitals can incorporate and benefit from lean enterprise principles. Additionally, for each of our recommendations we propose diagnostic questions for hospital leaders to evaluate whether or not they are following our recommended practices, and where appropriate, we also suggest both existing as well as new specific metrics to further inform hospital leaders' performance measurement.

Chapters 7 and **8** present our findings from studying in-depth the two large multispecialty hospitals while addressing RQ3 and RQ4. Notably, our analysis also pertained to our findings in Chapter 6, and vice-versa. In both cases, we began our exploratory study with senior leadership interviews and initially focused in one specific service unit in each hospital (i.e. Emergency Department, and Main Operating Rooms), as per each senior leadership's request. The concurrent data collection and analysis allowed to present, at various points, preliminary findings to senior leadership and in applying systems thinking principles, we gradually enlarged the scope of our analysis to include other embedded units of analysis which were sampled according to both perceptual and objective data pertaining to their performance (i.e. polar cases of high or low performing service units). Each embedded unit of analysis was examined both locally and in the context of its respective overall hospital enterprise architecture. Furthermore, emergent phenomena of interest were compared and contrasted both across embedded units of analysis within each case, as well as across cases (i.e. Hospital ABC and Hospital XYZ). Finally, each hospital's EA is described both in terms of each EA View, and the dominant EA View interactions that emerged from the data, while already leveraging our enriched version of MIT's NREAF.

9.3 Conclusions

We present our conclusions from the research described above by responding to the initial research questions as formulated in Chapter 1.

9.3.1 RQ1: How is hospital enterprise performance currently measured?

In our preparatory research phase (see section 5.2.2) we conducted exploratory hospital studies and determined that despite a hospital's favorable external ranking, there were dysfunctionalities that were neither captured by the metrics of the external entities, nor by those of the hospital itself. As such, we conducted the literature reviews presented in Chapters 2 and 4, to determine how we should measure hospital enterprise performance. In doing so we identified a trend in that, the number of performance dimensions considered in published articles increased over time, following the maturation of the performance management literature that recognized the need for multidimensional performance measurement. However, the literature review also characterized an inverse relationship between the number of performance dimensions considered and the inclusion of empirical data in the studies (i.e. beyond a conceptual contribution on how to measure hospital performance). Moreover, as the number of performance dimensions included in the studies increased, the inclusion of data in such studies decreased. Furthermore, we determined that the performance dimension most often used in the literature was hospital operations, followed by finance, and quality of care. Ultimately, there was sparse empirical evidence as to how hospitals currently measured enterprise performance, and hence the formulation of RQ1.

In studying the seven leading Massachusetts hospitals (see Chapter 6), using both qualitative and quantitative data, we established that they not only adopted a multidimensional performance construct but also defined hospital enterprise performance as remaining viable organizations whilst scoring well in as many performance dimensions as possible. Furthermore, despite typological differences across the sampled hospitals, we determined that their mission elements and key stakeholders considered were largely consistent.

Additionally, having studied both explicit and implicit performance measurement practices of each hospital, we identified 11 key practices and found that these were inconsistently aligned with lean enterprise principles (see Figure 9-1).

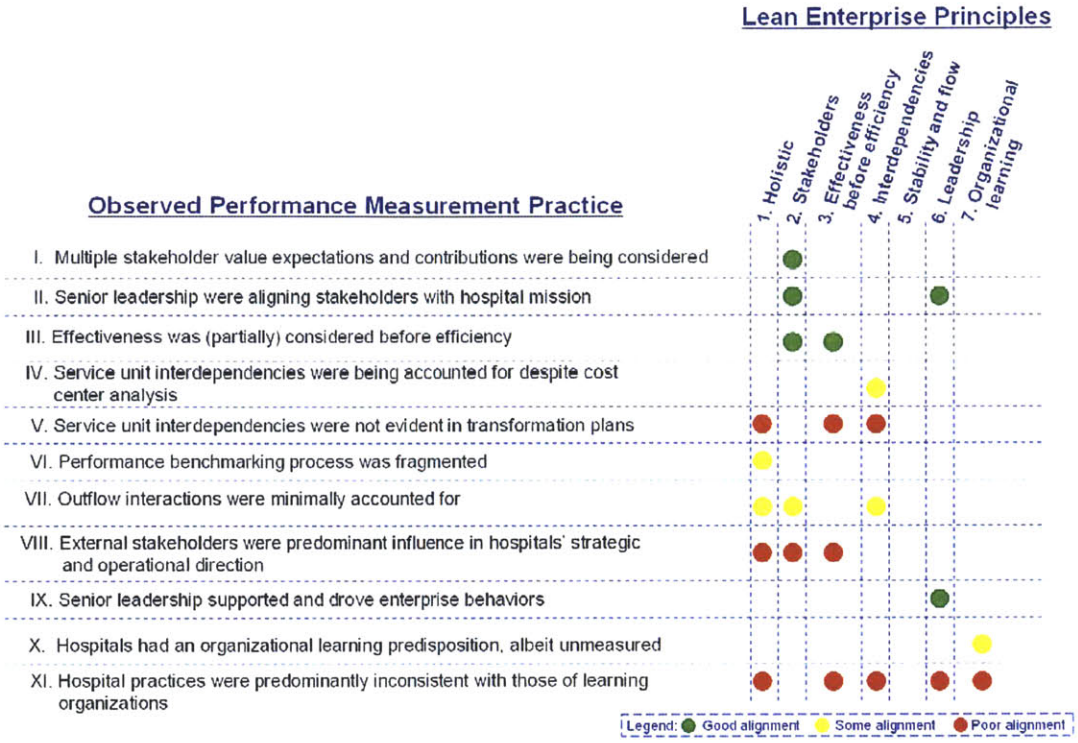

Figure 9-1: Summary of 7 MA hospitals key practices alignment with lean enterprise principles[216,217]

Figure 9-2 summarizes the evidence that we showed pertaining to each key practice. The following is a short summary of some of these practices and their alignment with lean enterprise principles:

- Multiple stakeholder value expectations and contributions were being considered: the sampled hospital identified relevant stakeholders and determined their value propositions accordingly.

[216] A simple coloring scheme was used to help readily visualize the alignment of hospital enterprise practices with lean enterprise principles (i.e. green denotes good alignment, whereas yellow denotes some alignment, and red indicates poor alignment and most room for improvement).

[217] The 5th lean enterprise principle (i.e. ensure stability and flow within and across the enterprise) didn't emerge as a dominant phenomena of interest in the analysis. However, we argued by inference, and from principles 1 and 4 in particular, that the sampled hospitals likely weren't well aligned with the 5th principle either, or at least they weren't consciously and proactively addressing it. Notably, evaluating an organization in terms of the 5th principle lent itself to the RQ3 and RQ4 in-depth study approach.

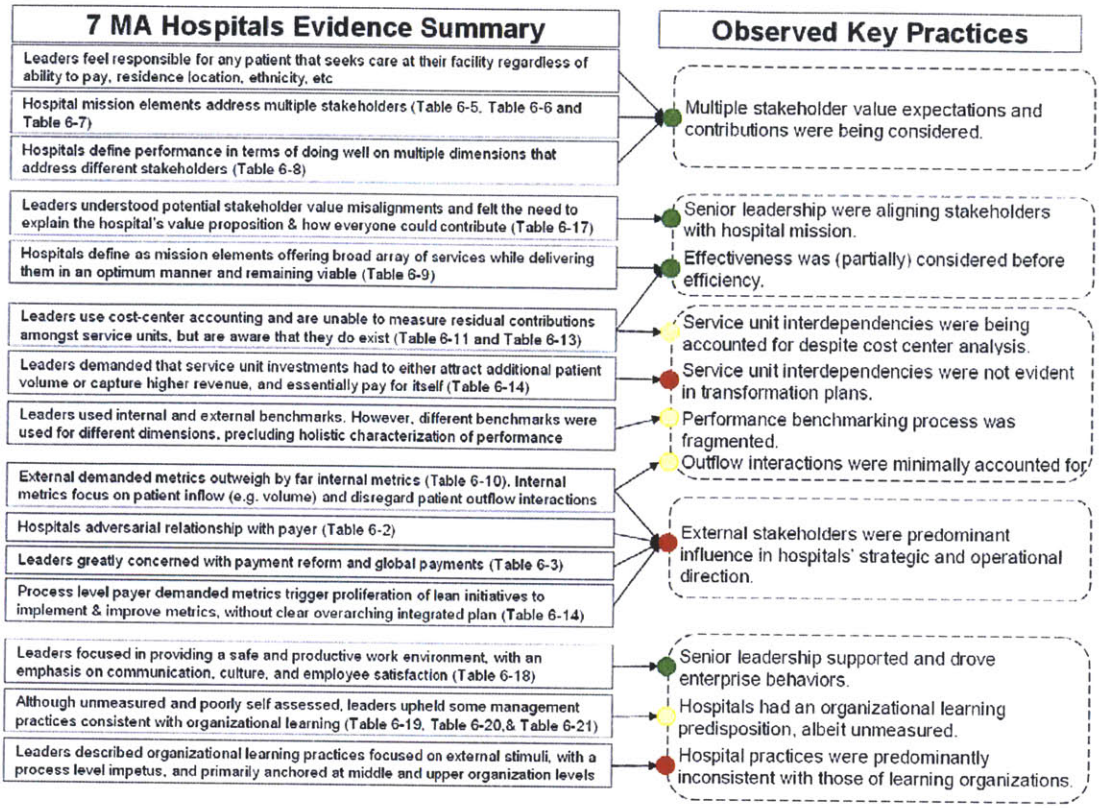

Figure 9-2: Summary of 7 MA Hospitals Evidence and Observed Key Practices Alignment with lean enterprise principles (adapted from Chapter 6) [218]

- Senior leadership supported and drove enterprise behaviors: senior leaders were mindful towards shaping an enterprise environment conducive of higher performance by keeping employees satisfied, communicating clearly, nurturing and sustaining the desired culture, and ultimately focusing on the delivery of excellent patient care.
- Service unit interdependencies were being accounted for despite cost center analysis: senior leaders recognized that interdependent service units may have a residual contribution towards each other. However, their systems not only didn't measure said interdependence, but also had a narrow focus (e.g. volume per service unit; volume per procedure; metrics per DRG; etc) and were tied to narrow incentives (i.e. motivating individualistic behavior rather than

[218] The full detail on each lean enterprise principle, as well as the assessment of the hospital key practices in terms of said principles, was described in section 6.5.1.

cooperative).

- Performance benchmarking process was fragmented: hospitals used both internal and external benchmarks to compare themselves with similar facilities. However, not only did they use different benchmarks for different performance dimensions (i.e. precluded holistic baseline performance measurement content), but also different managers were responsible for monitoring and improving different performance dimensions (i.e. precluded holistic performance measurement process).
- External stakeholders were predominant influence in hospitals' strategic and operational direction: not only the number of externally demanded metrics significantly outweighed the internal hospital metrics, but also senior leaders defined as strategic objectives the implementation of externally demanded metrics, and the improvement on the specific processes measured by said metrics. Furthermore, a clear overall process improvement rationale was absent; hence, hospitals predominantly focused on improving local efficiencies, and potentially compromised overall hospital effectiveness.
- Hospital practices were predominantly inconsistent with those of learning organizations: although hospitals had organizational learning capabilities, they had inconsistencies that prevented them from behaving as learning organizations. For instance, improvement empowerment was focused at senior leadership and management levels (i.e. front line employees weren't by definition empowered to seek improvements). Also, improvement efforts predominantly stemmed from external stimuli (i.e. adaptive learning) and didn't include generative learning (i.e. figuring out how to improve a process even though said process isn't directly monitored/demanded by external entities). Additionally, improvement efforts and transformation plans tended to be narrowly focused inside service units, and didn't have a description of potential enterprise level effects and opportunities to replicate results.

In the next research question we made recommendations that not only leveraged the good key practices that emerged from the sampled leading hospitals, but also addressed the practices that had room for improvement while using a systems thinking perspective.

9.3.2 RQ2: How could hospital enterprise performance measurement be improved using lean enterprise principles?

In line with the literature's recommendation in deriving useful best practices, we theoretically enriched each of LAI's lean enterprise principles, which originally were primarily empirically and expert opinion based (Nightingale 2009). As such, we conducted a literature review included in Chapter 2[219], and studied key publications spanning across six decades to find theoretical support for each lean enterprise principle. Notably, the in-depth cases studied (i.e. Hospital XYZ and Hospital ABC) also prompted revisiting the literature to further clarify each lean enterprise principle, and in some cases make suggestions for their refinement (e.g. the 7th lean enterprise principle should emphasize becoming a learning organization, rather than merely emphasizing organizational learning). Arguably, some of the principles could have had a list of thousands of articles to characterize them, as their concepts have been independently and prolifically developed in multiple fields. As such, we clarified that the seven lean enterprise principles weren't novel in themselves, but in combination they are the most complete as compared to other listings of lean principles in the literature.

In answering RQ1, we identified 11 key practices and found that these were inconsistently aligned with lean enterprise principles. Hence, in line with the overarching motivation previously described (see section 9.1) we set ourselves to improve hospital enterprise performance measurement while using lean enterprise principles.

We defined 5 specific recommendations as to how hospitals can incorporate and benefit from lean enterprise principles (see Figure 9-3). In doing so, we introduced a core concept of service architecture awareness which should be embedded at all levels of the hospital enterprise and inform the planning and execution of lean improvement initiatives,

[219] See section 2.4.6.1 and Appendix I

transformation plans, organizational learning, and performance measurement in general. Notably, this construct also emerged as a central phenomenon of interest in the analysis of the two in-depth hospital cases addressed in RQ3 and RQ4, and became embedded in our enriched version of NREAF's Service EA View (i.e. Service Architecture Awareness/ Appreciation).

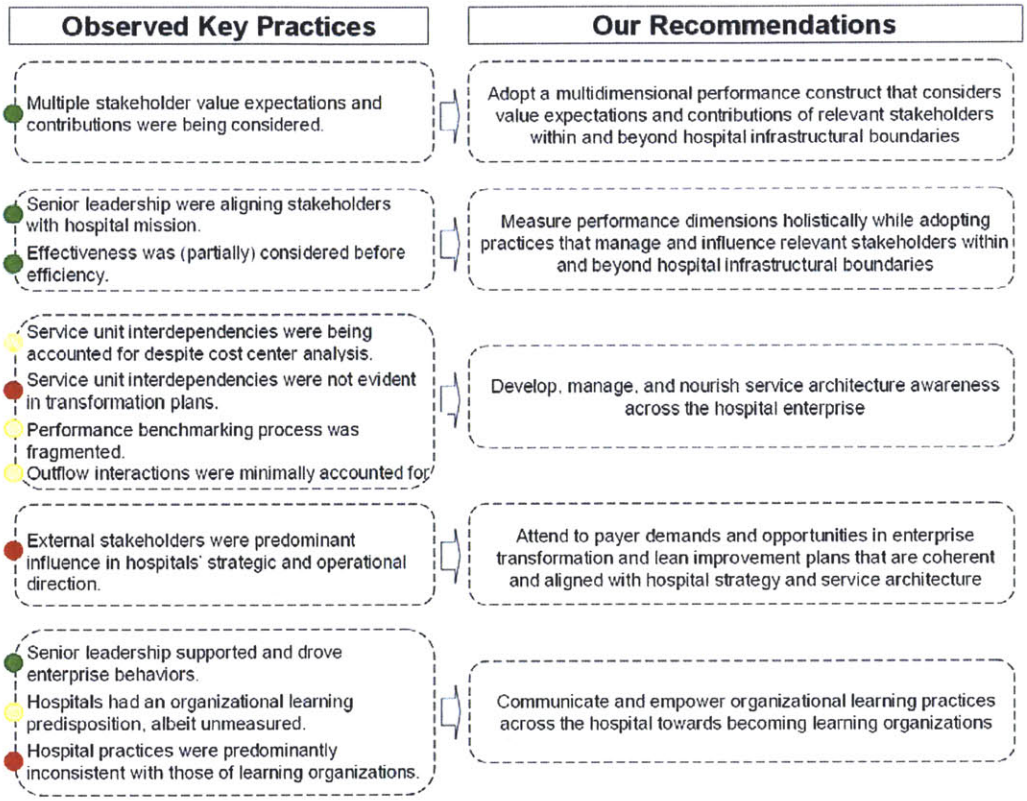

Figure 9-3: Lean Enterprise Principle Recommendations for Hospitals (from Chapter 6)[220]

A total of 26 diagnostic questions were suggested for senior hospital leaders to evaluate whether or not they are currently following our 5 recommended practices which are informed by lean enterprise principles.

Additionally, we identified 22 specific metrics for the 8 performance dimensions we recommended (i.e. quality, finance, operations, patient satisfaction, employee satisfaction,

[220] The full detail on each recommendation, including proposed diagnostic questions and metrics, was described in section 6.5.2.

organizational learning, strategy/operations alignment, and social equity)[221]. Furthermore, 9 new metrics were suggested specifically to measure service architecture awareness in a hospital context.

All in all, in answering RQ1 and RQ2 we made good progress towards our research motivations of elevating the traditionally narrow hospital definitions of lean healthcare, and of both characterizing and improving hospital performance measurement in particular. In doing so, we also became more knowledgeable to conduct our in-depth hospital studies. Specifically, most of our suggested diagnostic questions and metrics were used to inform the analysis of the two in-depth hospital case studies summarized in the next two research questions.

9.3.3 RQ3: Can one create an enriched understanding of hospital enterprise architecture?

In our longitudinal multidisciplinary literature review analysis of Chapter 3, we determined that MIT's emerging Nightingale-Rhodes Enterprise Architecture Framework (NREAF) is the most complete framework representation of enterprise architecture (EA), and thus was selected to guide the data collection of our two in-depth hospital case studies. However, we also established the need to adopt an enterprise diagnostic mindset[222] and also theoretically and empirically enrich the NREAF beyond its early diagrammatic representation (Nightingale and Rhodes 2007) and succinct EA View descriptions (Nightingale 2009)[223]. Moreover, the NREAF represented preliminary

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[221] The sampled hospitals' highest ranking metrics per performance dimension were described in Table 6-24 and in section 6.5.2. Also, please refer to Appendix II for the full list of metrics that were dominant in the literature, and were then presented to all of the hospital CEO respondents. The 22 metrics identified were consistently ranked highest by the CEO respondents.

[222] An architecting mindset is implicit in the heuristics of EA View interactions depicted in the NREAF. However, our literature review in Chapter 3 uncovered frameworks whose element interactions (i.e. EA View interactions) were consistent, inconsistent, and also additional (see section 3.5). Hence, in line with our research motivation of furthering the nascent development of MIT'S NREAF, we elected to follow an enterprise diagnostic mindset, and in doing so, we didn't limit our EA View interaction analysis to any particular set of pre-defined heuristics and allowed instead for the phenomena of interest to emerge from the data. Notably, having conducted our exploratory in-depth hospital case studies and enriched MIT'S NREAF, we also propose general recommendations (i.e. we adopt an architecting mindset) for hospitals in section 9.4.

[223] The author's NREAF starting point, both in terms of its representation and its EA View descriptions, was explained in detail in section 3.4.3.

generalized results from several years of empirical studies and should also be adapted to the specific context of each enterprise under analysis (Rhodes, Ross et al. 2009).

Having leveraged and enriched the NREAF while conducting our two exploratory in-depth hospital case studies, we showed that one can indeed create an enriched understanding of hospital enterprise architecture. Specifically, we identified 24 main categories and 53 subcategories for MIT'S NREAF (see Figure 9-4 and Figure 9-5)[224].

Each of the categories emerged consistently in the analysis of the qualitative and quantitative data from both in-depth hospital case studies. Grounded theory techniques (e.g. initial coding, focused coding, categorizing, memo writing, sorting, coding visualization, etc) were used in the identification of each of the categories enriching MIT'S NREAF[225] for hospital applications in particular. Throughout the data collection and analysis we were informed by our findings in RQ1 and RQ2, as well as by the lean enterprise principles, and additional literature reviews to aid in our categorization and interpretation of the data. Notably, in collecting and analyzing the enlarging data sets (i.e. 54 interviews, 15 non-participatory meetings, 9 walkthroughs, electronic medical records, 420+ literature publications, and internal documents), we gradually upgraded from analyzing data on paper, to Microsoft Excel, and finally to a specialized tool for qualitative data analysis (i.e. MAXQDA10).

[224] The full detail on each main category and subcategory was described in section 7.7.2.
[225] An overview of the data analysis process was described in section 5.4.

Figure 9-4: Main Categories of Enriched NREAF (from Chapter 7)

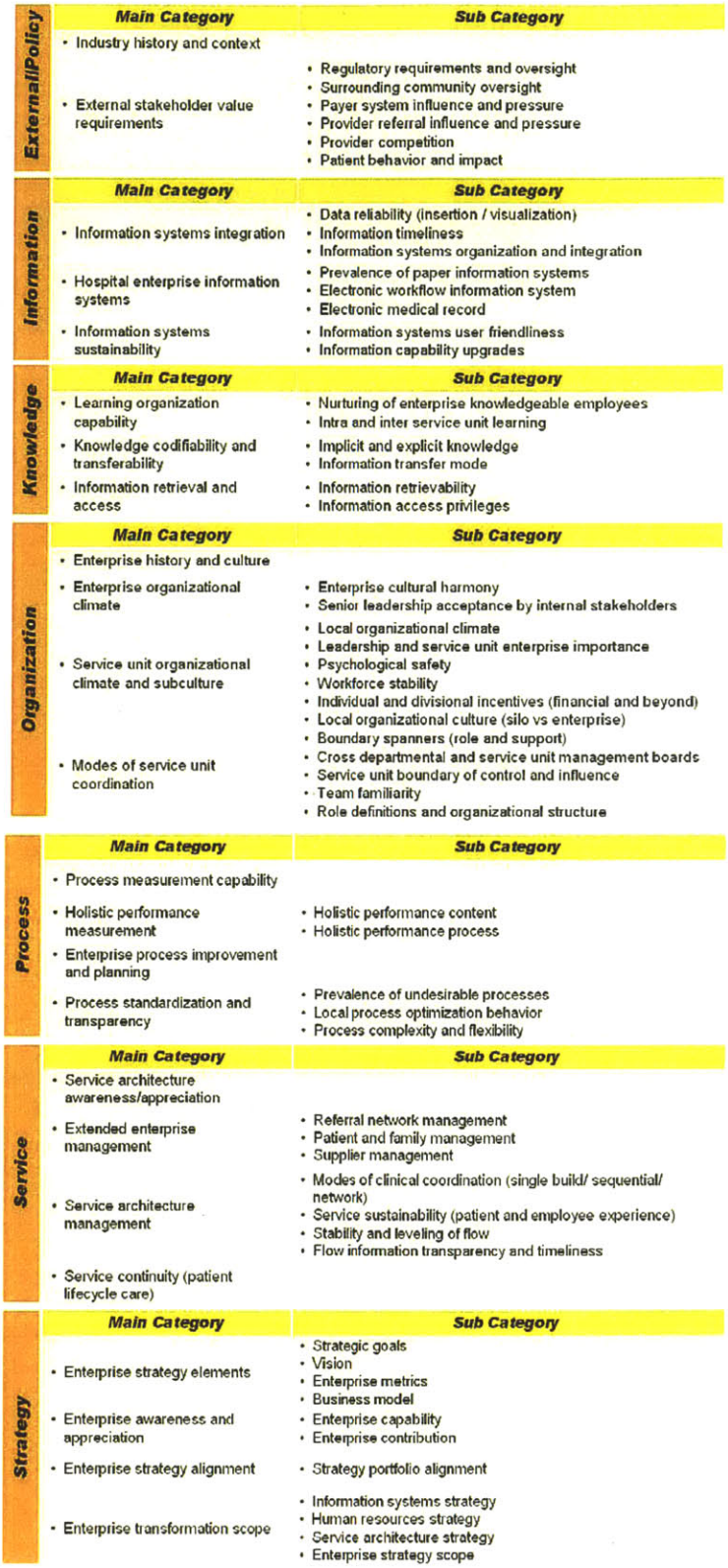

Figure 9-5: Subcategories of enriched NREAF (from Chapter 7)

In total, over 8000 coding instances were generated in the software and underwent the abovementioned grounded theory techniques that led to each of the main categories and associated subcategories for each EA View. Furthermore, the software supported data triangulation across data types (e.g. interviews and observation), and across embedded units of analysis (e.g. emergency department and inpatient service unit), as well as testing of results replication across the two in-depth hospital case studies (i.e. Hospital XYZ and Hospital ABC). Finally, the software also supported us in characterizing relationships among subcategories within and across EA Views, and in effectively building a log of EA View interactions in each of the in-depth hospital case studies. Notably, the EA Views in Figure 9-4 and Figure 9-5 are ordered alphabetically as we remained consistent with our elected diagnostic enterprise mindset.

The following is a summary list of key EA View refinements made whilst enriching MIT's NREAF:

- The **External / Policy EA View** was characterized not only in terms of regulatory, political and societal considerations (i.e. as originally described in the NREAF), but also in terms of the enterprise industry history and context. Furthermore, we felt it was necessary to also explicitly include the effects of competition. Notably, several of this view's identified subcategories pertain specifically to the healthcare industry (i.e. patients, referring providers, payers, surrounding community).
- The **Information EA View** was characterized not only in terms of the information needs of the enterprise (i.e. as originally described in the NREAF), but also in terms of the reliability of the information, its timeliness, its organization, and its integration. Furthermore, we explicitly denoted the existence of information systems that are either paper-based or electronic. Specifically, as with any other enterprise, we found that hospital information flowed in both types of systems, and in some cases only in one of them. Additionally, we added information systems sustainability in terms of their ease of use, and an enterprise's ability to upgrade them (e.g. off-the-shelf solutions vs. internally developed). Notably, some of this view's subcategories pertain specifically to the

healthcare industry (i.e. electronic medical record). Finally, we also explicitly characterize electronic workflow information systems, as these emerged as a core capability which hospitals should ideally have in place. Similarly, we determined that state-of-the-art electronic medical records aren't necessarily conducive on their own to better information flows; conversely, we also identified paper-based practices that indeed adequately supported information flow.

- The **Knowledge EA View** was characterized not only in terms of implicit characteristics (i.e. as originally described in the NREAF), but also in terms of explicit codified knowledge (e.g. evidence based medicine). Furthermore, we added the core learning organization capability, which reflects the 7th lean enterprise principle, and one of our RQ2 recommendations in particular[226], and assesses whether or not the enterprise is nurturing enterprise knowledgeable employees and promoting intra and inter service unit learning. Notably, organizational learning practices (e.g. trial and error adjustments) pertain to the Process EA View. However, as clarified elsewhere in this thesis[227] organizational learning practices are a necessary but insufficient condition for an enterprise to develop into a learning organization. Finally, we also consistently identified information retrievability and access privileges as core constructs defining the EA Knowledge View (e.g. knowledge existed in the enterprise somewhere but stakeholders were either explicitly denied access to it, hence limiting learning capability, or it couldn't be readily tapped, whether in explicit or implicit format).
- The **Organization EA View** remained largely consistent with the originally described NREAF; however, we added several constructs which reflect and emphasize an enterprise's multiple levels of analysis. At an enterprise level we characterized its history, culture, overall cultural harmony, and the acceptance of senior leadership by internal stakeholders. At a local level we identified and leveraged a series of widely published constructs (e.g. psychological safety, team familiarity, boundary spanners, boundary of control and influence, local organizational culture, etc). Furthermore, we explicitly added individual and

[226] The specific recommendation was: "Communicate and empower organizational learning practices across the hospital towards becoming learning organizations".
[227] See section 6.4.3.

divisional incentives, financial and otherwise, as these helped explain behaviors within and across service units.

- The **Process EA View**, although not described in detail in the original NREAF, features constructs which have been described extensively elsewhere[228]. Hence, several of the categories which emerged from the data were related to the original constructs described in the NREAF (i.e. process measurement capability, holistic performance measurement content, enterprise process improvement and planning). However, additional constructs also consistently emerged from our data analysis. Specifically, the holistic performance process accounts for two of our RQ2 recommendations[229], whereby performance measurement content and process are explicitly characterized (e.g. different managers were responsible for monitoring and improving different performance dimensions, thus although holistic content was available, it wasn't holistically analyzed). Furthermore, we characterized the existence of prevalent undesirable processes (which might be standard or otherwise), as well as local process optimization behavior (which might have a positive or negative impact).
- The **Product EA View** wasn't dominant in our characterization of hospital enterprise architectures. There were indeed products being developed (e.g. surgical kits are comprised of multiple medical instruments put together for a particular procedure and surgeon); however, hospitals predominantly deliver services within and across service units, and very few products were characterized in the data analysis. As such, the Product EA View couldn't be enriched in the context of our research.
- The **Service EA View** is a distinguishing characteristic of the NREAF as determined in our literature review framework comparison[230]; however it also was

[228] The core leadership, lifecycle, and enabling processes are integral constructs from LAI's Lean Enterprise Self-Assessment Tool (LESAT). See: http://lean.mit.edu/products/lean-enterprise-self-assessment-tool-lesat/download-lesat.html

[229] The specific recommendations were: "Develop, manage, and nourish service architecture awareness across the hospital enterprise" and "Measure performance dimensions holistically while adopting practices that manage and influence relevant stakeholders within and beyond hospital infrastructural boundaries".

[230] A synthesis of the comparison of MIT's NREAF to 10 influential frameworks was presented in section 3.5 and Table 3-4 in particular.

one of the most succinctly described EA Views in the original NREAF[231]. Hence, all of the Service EA View's main categories and associated subcategories now featured in the enriched NREAF, consistently and specifically emerged from the data (i.e. service architecture awareness/appreciation, extended enterprise management, service architecture management, and service continuity (patient lifecycle care)). The emerged categories are related to one of our RQ2 recommendations in particular[232]. Notably, the service architecture awareness/appreciation and the service sustainability constructs, reflect core phenomena which consistently emerged from the data (e.g. whether or not people make decisions whilst aware of their potential impact downstream and upstream, and ultimately to the patient and employee experience).

- The **Strategy EA View** was characterized not only in terms of goals, vision, and metrics (i.e. as originally described in the NREAF), but also in terms of enterprise strategy alignment, enterprise strategy scope, and enterprise awareness and appreciation. The emerged categories are related to two of our RQ2 recommendations in particular[233]. Notably, these categories reflect core phenomena which consistently emerged from the data (i.e. tension between strategy portfolio and hospital delivery platform; service unit residual contribution unappreciated by senior leaders; narrowly focused transformation plans).

In Chapter 3 we clarified that the meaning of holistic pertains not only to an enlarged number of EA views used in a framework but also to an "*understanding of the interactions of the views [which] becomes of increased importance*" (Rhodes and Nightingale 2008). As noted before, this research adopted an enterprise diagnostic mindset and held no pre-conceived notion of organizational element interactions including strength and direction.

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[231] The Service EA View was originally succintly described as: "*Services(s) delivered and or supplied by the enterprise, including in support of products*" (Nightingale 2009).

[232] The specific recommendation was: "Develop, manage, and nourish service architecture awareness across the hospital enterprise".

[233] The specific recommendations were: "Adopt a multidimensional performance construct that considers value expectations and contributions of relevant stakeholders within and beyond hospital infrastructural boundaries" and "Attend to payer demands and opportunities in enterprise transformation and lean improvement plans that are coherent and aligned with hospital strategy and service architecture"

Using our enriched version of MIT's NREAF we identified hundreds of EA View interaction instances, including direction and to some extent strength, over the course of our analysis, as evident in the detailed descriptions for each in-depth hospital case study. A total of 23 dominant EA View interactions emerged from our analysis of Hospital ABC and Hospital XYZ, which further enriched our understanding of hospital enterprise architecture[234]. Notably, our descriptions of the dominant EA View interactions included a range of three to all seven EA Views. In effect, we derived multiple holistic descriptions for each hospital's enterprise architecture, and reached closure (i.e. theoretical saturation was attained as the analysis of additional embedded units only revealed small marginal improvement (Eisenhardt 1989)).

In the next research question we leveraged our enriched understand of hospital enterprise architecture and explored whether the in-depth hospital case studies had such an understanding, and if so, whether they had made decisions which reflected said understanding and improved their performance.

9.3.4 RQ4: Can hospital performance be improved through an enriched understanding of hospital enterprise architecture and if so, how?

In both cases we verified that the initially studied service units (i.e. ED, Main ORs) were indeed experiencing poor performance as measured by both perceptual (i.e. interviews and observation) and objective data (i.e. archival records and/or internal documents). However, we also established that both service units were being significantly affected by their interactions with stakeholders beyond their unit boundary. Furthermore, we found that different service units were consistently characterized, again with both perceptual and objective data, either with poor or high performance, and warranted analysis. In comparing each of the embedded units of analysis, within and across case studies, we found that an enriched understanding of hospital enterprise architecture, can inform decisions which ultimately improve hospital performance (see Figure 9-6).

[234] The dominant EA View interactions were described in sections 7.3.3.2, 8.4.3., 8.5.8., 8.6.1.8., and 8.6.2.8.

In both cases we found that a hospital enterprise may consist of multiple internal architectural configurations, and that these in turn may generate different levels of hospital performance, where performance is measured as a multidimensional construct, both in terms of dimensions and stakeholders. Specifically, we established that:

- In **Hospital XYZ**, unlike its inpatient service unit 5W (i.e. worse performer), the inpatient service unit 7C had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream.
- In **Hospital ABC**, unlike its Neuro ORs and Main ORs (i.e. worse performers), the Cardiac ORs had gradually developed an enriched understanding of hospital enterprise architecture, and had made decisions which improved not only their local performance but also enhanced its interactions with other service units upstream and downstream.

In comparing the overall enterprise architectures of both hospital cases, we derived the following additional key insights:

- **Fragmented multispecialty hospitals**: the healthcare literature[235] considers integrated multispecialty providers as being better able to offer efficient higher quality care, as compared to what is traditionally described as the provider *cottage industry* (i.e. the majority of providers consists of physician group practices of five or less elements). Both hospitals were clearly successful as evidenced by their strong financial numbers and multiple awards given by 3rd party organizations. However, our characterization of multiple internal architectural configurations shows that each hospital had some service units which, although interdependent with others, made decisions and operated independently from them. Additionally, we found that information systems weren't integrated and largely so because of localized decision making, which contributed to the fragmentation within each hospital.

[235] See section 4.5.3.

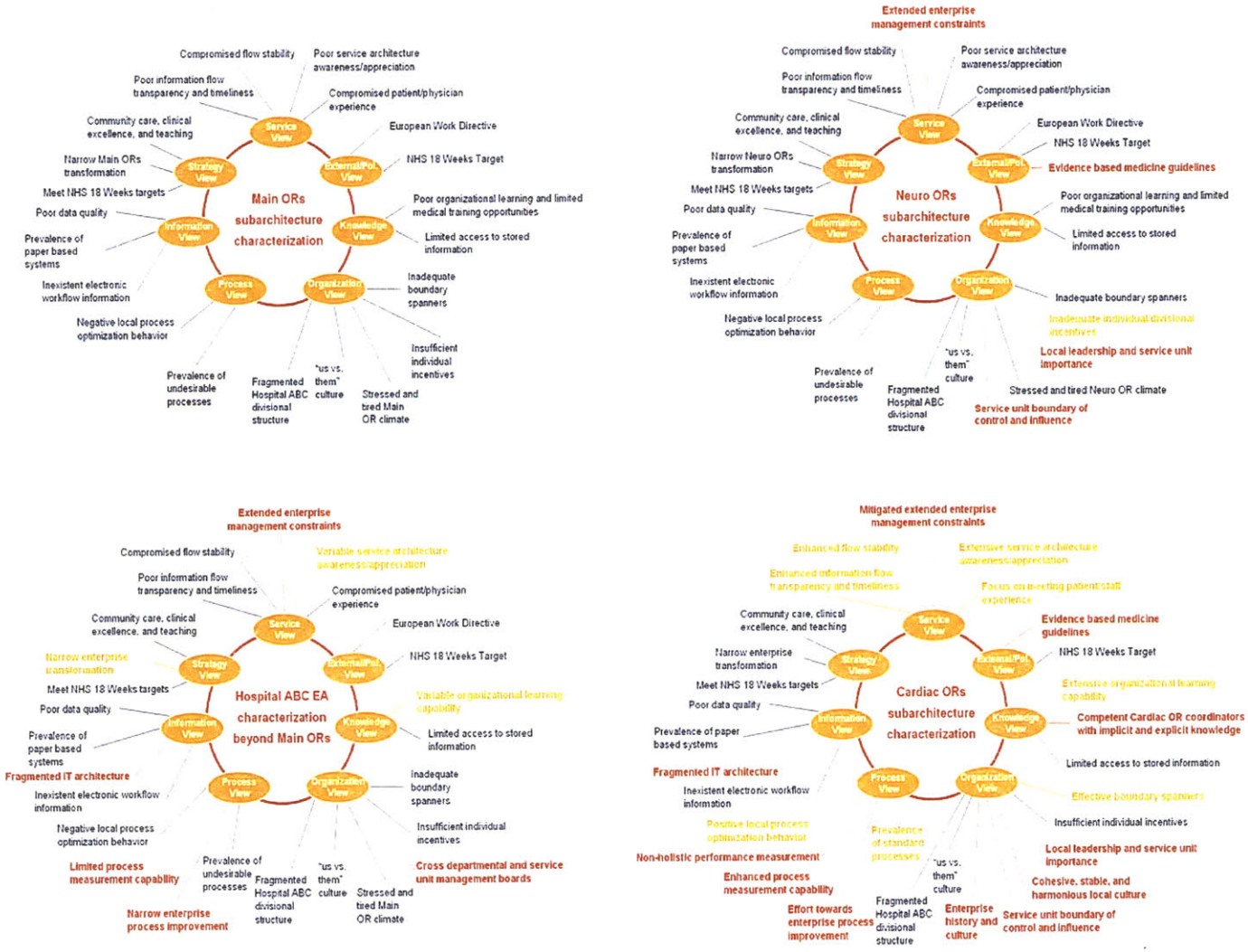

Figure 9-6: Overview of Hospital ABC's sub-architecture analysis summaries (from Chapter 8)

- **Senior leadership's poor service architecture awareness/appreciation**: both cases started within specific poorly performing service units which were being held primarily accountable by each hospital's senior leadership. Furthermore, we identified that transformation and improvement plans in both cases hadn't adequately reflected each hospital's service architecture. In effect, senior leaders in both hospitals would stand to benefit from adopting the following RQ2 recommendation: "Develop, manage, and nourish service architecture awareness across the hospital enterprise".
- **Similar operational and strategic issues**: the in-depth hospital cases took place in the US and UK respectively; hence the sampled hospitals had significantly different characteristics at their External / Policy EA Views (e.g. different payment model and different regulatory constraints). However, we found that both hospitals were similarly experiencing tension between their strategy portfolio and their care delivery platforms. Specifically, in both cases there was tension in terms of teaching vs. efficient throughput, and also in terms of treating the surrounding community vs. striving for clinical excellence. Notably, these tensions are similar to those of cutting edge research institutions like MIT, who also want to teach undergraduate programs, which more often than not, aren't related to the research agenda[236].
- **EA Views may either constrain or support each other:** as noted above, both hospitals had significant constraints with predominantly non-integrated information systems. However, in characterizing the high performing internal architectural configurations of each hospital, we found that local leaders had consistently made changes to other EA Views, which ultimately compensated for their Information EA View related constraints. In effect, they embodied several of our RQ2 recommendations.
- **Different levels of enriched understanding of hospital enterprise architecture:** as noted previously, both cases had high performing internal architectural configurations with a similar enriched understanding of hospital

[236] The author hereby acknowledges that the comparison with MIT was originally noted by Professor Joseph Sussman.

enterprise architecture. However, when comparing across cases, we found that they had different levels of enriched understanding of hospital enterprise architecture as a whole. Specifically, we established that Hospital ABC not only had a service unit with an enriched understanding of hospital enterprise architecture (i.e. Cardiac ORs), but had also recently recognized and instituted changes (i.e. cross departmental and service unit management boards) to replicate and facilitate throughout Hospital ABC, the practices developed by the Cardiac ORs. In effect, Hospital ABC was further along in becoming a learning organization and ultimately a lean hospital enterprise.

9.4 Additional Specific Recommendations for Hospitals

In answering RQ1 and RQ2 we proposed several general recommendations, diagnostic questions, and metrics for senior hospital leaders to improve their performance measurement practices in particular, and inform their management practices in general. With the benefit of having answered RQ3 and RQ4, what follows is a series of specific recommendations which leverage our findings from the two in-depth studies, and hopefully will further assist senior leaders and their management and departmental leaders in architecting solutions more likely to improve their hospital enterprise performance:

- **Develop adequate information systems that support workflow performance measurement:** more often than not electronic medical records are primarily used to support the clinical and billing processes in hospital operations. Notably, a baseline requirement for information flow is that such systems be integrated seamlessly, in real time, and with as little human intervention as possible. However, information pertaining to workflow should also be specifically tracked. In both in-depth studies we determined that neither hospital had enterprise wide systems in place to support workflow. Over the course of our research, while sharing our findings with senior leadership, they made specific decisions that reflected our workflow analysis. For instance, they halted the purchase of expensive self-check-in kiosk for the emergency department as they realized that such represented less than 3% of patient throughput time. Similarly, they

supported the analysis beyond the initial service unit, as they became aware of the variability in inter-service unit interactions. However, it is important to note that we emphasize the need for ***adequate information systems*** as these may also be less sophisticated systems (e.g. paper-based, Microsoft Excel) provided that processes are in place to standardize data insertion, systematically aggregate information, and without burdening care givers. For instance, the high performing service units had instituted simple data tracking surveys to continuously measure their interaction with other service units, and devise solutions to address consistently poor interactions.

- **Leverage existing lean teaching courses to build service architecture awareness:** nowadays hospitals are more commonly offering lean teaching courses either facilitated by an internal team or external consultants. In general, having an internal team sharing their knowledge built on past successes is closer to the practices of learning organizations. However, whomever the course facilitator(s), it is important that these not only implement traditional lean methods (e.g. 5S, visual management, kaizen, etc) but also look towards building service architecture awareness across organizational levels. Indeed Gemba (Japanese term for "*the real place*") raised the importance of taking the lean class room to seeing where things are really happening. However, it is important that they think beyond the process level, and see beyond the individual service unit. Think of ways of how the course attendees could readily understand the importance of service architecture awareness, and suggest their own mechanisms to implement in their work area, so as to reflect such awareness. Alternatively, help them understand how their local optimization behaviors, albeit devised with the intent of mitigating service architecture deficiencies, had invariably resulted in a worse off hospital enterprise as a whole. Notably, perhaps a similar exercise would be useful for an executive class whilst examining their enterprise transformation and improvement plans, and assessing whether or not these reflect a service architecture awareness.

- **Implement flexible incentives which encourage cooperative relationships:** incentives in place should encourage cooperative relationships across interdependent service units. Moreover, service units should be encouraged and recognized for their joint effort in supporting patient throughput and quality of care. For instance, an emergency department (ED) not only provides urgent care to a surrounding community, but also supports the inpatient specialty services provided by a hospital, and whose payment mechanisms might not necessarily readily recognize the ED's contribution to inpatient revenue. Additionally, although salaried care givers are more likely to be less prone to misalignments induced by external financial incentives (e.g. hospitals are paid a flat fee regardless of length of patient stay, whereas physicians may be being paid at a per diem rate), they aren't necessarily without their own issues also. For instance, in both of our in-depth studies there were suggestions that some care givers didn't have an incentive to support throughput, as they would earn the same salary regardless of effort. However, we also observed individuals were highly committed to mitigating system dysfunctionalities, but were perhaps being stretched too far. Beyond throughput volume based incentives (i.e. the more you do the more you earn) it is also important to consider implementing non-financial incentives. Examples may include allowing employees to accumulate their additional work hours and take time off at a time of their choosing. Another example might be sharing resources across service units when one of them is experiencing downtime.

- **Create cross departmental and service unit management boards led by well respect individuals and with visible senior leadership support:** the notion of integrated product development teams has been extensively used in other complex system environments (e.g. aerospace and automotive manufacturers), and in our research we saw such a mechanism beginning to be implemented. Such mechanisms are important to facilitate communication across service units, enable transparency, encourage accountability, share lessons learnt, and devise solutions that consider the service architecture as a whole, rather than only a segment of it.

However, it is important that such management boards be either led by well recognized care givers (i.e. as in, not pure managers, who even might have been clinicians at some point), or jointly led by well recognized care givers and a clinically knowledgeable manager with good people skills. Furthermore, it is important that senior leadership provide visible support to the management board, so that the local leadership of each service unit recognize the legitimacy of the board, and more readily engage in its endeavors. Additionally, the management board should encourage the sharing of lessons learnt and assess whether or not these make sense to replicate, and in what order, across the hospital service architecture. Finally, the previous recommendation of flexible incentives that encourage cooperative relationships is particularly pertinent to support the functioning of those participating in the management boards.

- **Nurture and leverage hospital enterprise knowledgeable employees:** hospitals generally have career pathways which allow for employees to progress within the organization. Nurses for instance may gradually train from an inpatient service unit setting towards a higher level of specialization such as the intensive care unit or the emergency department. Medical students rotate across different service units as they complete their training. Medical residents similarly rotate across service units, albeit more concentrated in their given specialty. However, once fully trained, physicians are not only likely to practice in a different setting than where they were trained, but also are likely to remain extremely insolated in their own practice setting (e.g. hospital department and/or clinic). In the case of medical residents, it would seem highly pertinent to institute policies which leverage their enterprise knowledge in interacting in different service units, with different physicians, and different nurses. Notably, medical residents may also act as a buffer between nursing and senior physician staff (i.e. more often than not nurses and physicians either have arm's length relationships, or experience poor psychological safety amid an organizational blame culture). In general, it would seem appropriate and advisable to allow for different stakeholders to circulate across service units (i.e. beyond the purpose of training), so as to build and

maintain their understanding of the enterprise and its service architecture, as well as foster informal collaborative relationships.

- **Place knowledgeable and dedicated boundary spanners across the service architecture:** boundary spanners are those individuals who facilitate key information beyond the boundary of their particular service unit. However, in a hospital context the term needs further refinement. Specifically, hospital operations rely on care givers to share information via their information systems, in person, or through some other means, whenever they execute a patient handoff or carry out a patient consult. However, our recommended boundary spanners are individuals who systematically and proactively engage with other service units in order to support information and patient flow across the service architecture (i.e. not just because it is the end of a shift or because they need to transfer a patient). In this research we uncovered the examples of the Cardiac ORs clinical coordinator (i.e. Hospital ABC) and that of the Charge Nurse of 7C (i.e. Hospital XYZ). Both of them went above and beyond their job requirement and routinely engaged and facilitated interactions with other service units. Notably, the Cardiac ORs also created boundary spanner positions, although of a lesser hierarchical position, to specifically support the interaction with inpatient service units via cardiac nurses.

9.5 Contributions

As a way of summarizing, we suggest that the contributions of this research are as described below:

In this research we contributed to the study of enterprise architecture and hospital enterprises in particular.

We did so by:

(i) conducting longitudinal and multidisciplinary literature reviews:

a. Comprehensive coverage of the literature on lean principles whilst theoretically enriching LAI's seven lean enterprise principles (Chapter 2).

b. Providing an overview and comparison of enterprise architecture frameworks and explicitly using lean enterprise principles in deriving and interpreting holistic and rich enterprise architecture descriptions (Chapter 3).
c. Synthesis of the healthcare literature on hospital performance measurement (Chapter 2) and hospital characteristics (Chapter 4).

(ii) enriching MIT'S NREAF with 24 main categories and 53 subcategories, and identifying 23 dominant EA View interactions (Chapters 7 and 8).

(iii) introducing service architecture awareness and multiple internal architectural configurations constructs, to support in the diagnosis and architecting of enterprises (Chapters 7 and 8).

(iv) enriching our understanding of hospital enterprise architecture while holistically describing two different hospital enterprise architectures and several of their internal architectural configurations (Chapters 7 and 8).

(v) elevating hospitals' traditionally narrow lean understanding by providing them with lean enterprise based recommendations, diagnostic questions, and metrics, as follows: 5 recommendations, 26 diagnostic questions, 22 metrics addressing 8 performance dimensions, and 9 new metrics to specifically measure service architecture awareness (Chapter 6).

(vi) developing a set of specific architecting recommendations for hospital leaders to consider (Chapter 9).

9.6 Promising Areas of Future Work

A deliberate strategy in this research was to leverage lean enterprise principles whilst exploring enterprise architecture in the context of hospitals. The choice of the healthcare context was deliberate in order to not only address the joint call for research by the NAE and the IOM, but also to introduce and explore MIT'S NREAF in a new domain. Furthermore, the investigation was further designed to reflect literature recommendations of focusing on a single domain (Galbraith 1974; Van de Ven and Ferry 1980), and also carefully sampling using key factors (i.e. hospital typology used in Chapter 6, and multidisciplinary hospitals used in Chapters 7 and 8) within the chosen domain (Ginsberg

and Venkatraman 1985). However, a limitation of this research remains that it is only focused in healthcare, and therefore, the first opportunity for future work is to extend the research into other large-scale complex engineering contexts in other industries in order to validate and build on the current insights in this thesis.

Another opportunity for future research is in leveraging our enriched version of MIT's NREAF to design structured questionnaires to be administered to a wider hospital sample. The focus in this research was on building an enriched understanding of hospital enterprise architecture, while elevating hospitals' traditionally narrow definitions of lean, and furthering the development of MIT's emergent NREAF. To that effect we followed the literature's recommendation of conducting more than one case study with embedded units of analysis (Strauss and Corbin 1990; Yin 1994), and doing so in an in-depth manner (Campbell 1977; Sloan 1980), while cognizant that hospitals' information capabilities generally pose a severe limiting factor given the cost of collecting data (Mehrotra, Lee et al. 2003). Nonetheless, we coded over 8000 coding instances stemming from 54 interviews, 420+ literature publications, internal documents and observations done at two large multispecialty hospitals, totaling 13 embedded units of analysis, and 24,200 electronic patient records[237]. The design of structured questionnaires informed by our enriched version of the NREAF, as well as our proposed diagnostic questions, will allow to substantially reduce the cost of data collection, and to study a wider hospital sample. This would directly extend the current research by measuring the main categories and subcategories of each of the EA Views, while using a wider hospital sample, so as to identify potential patterns across EA Views, within and across hospitals. In effect we would be closer to addressing the question: how does hospital enterprise architecture relate to hospital enterprise performance? Furthermore, in our healthcare literature review (i.e. Chapter 4) we observed that scholars had questioned research and policy approaches that ignored the heterogeneity of healthcare practice settings (e.g. data systems, organization structure, culture, etc), and expected that isolated policies and techniques could uniformly address the full array of hospitals (Evashwick and Weiss 1987; Flood

[237] Electronic medical records were integrated across three separate systems at Hospital XYZ to provide for an end-to-end patient flow analysis.

1994; Hussey, Eibner et al. 2009). Hence, the importance of this future work would also then be to further inform our enriched understanding of hospital enterprise architecture, and assist us in recommending improvement initiatives and policies not only for hospital senior leaders, but also for regulatory agencies.

Yet another opportunity for future research is in further examining the UK's NHS 18 Weeks hospital treatment intervention, which specifically targeted each individual hospital, not only by issuing penalties for each and every patient that wasn't treated in the designated time period, but also by publically sharing their compliance records and influencing patient referral patterns. Notably, one would be hard pressed to find patients in the US who would consider reasonable waiting for 18 Weeks for their hospital treatments, let alone anything longer than that, hence it is understandable that the UK's public pressured the NHS into taking action. However, the analysis in this thesis found that the 18 Weeks policy had had both positive and negative impacts on Hospital ABC, and perhaps the regulatory agency should reconsider its approach. On one hand, we found that, unlike Hospital XYZ (i.e. US hospital), Hospital ABC (i.e. UK hospital) had a clear sense of direction set by one external key stakeholder (i.e. the NHS) as opposed to a vastly fragmented payer-mix and regulatory agencies. We also found that 18 Weeks was not only strongly present in senior leadership's thinking, but also at all levels of the hospital enterprise, which further provided for a common goal and direction. On the other hand, as noted in our literature review in Chapter 2, if inadequately designed, performance metrics can have unintended consequences. For instance, Hospital ABC was already struggling with coping with the European Working Time Directive which had drastically reduced working time to 48 hours a week, hence it had even less resources (notably junior doctors) to treat patients. Also, the 18 Week policy revolved around time to treatment, and said nothing about the outcome of said treatment. Effectively, to what extent were treatment decisions replacing patient care urgency with 18 Weeks sanction avoidance? Also, it would be interesting to examine how patients' hospital length of stay changed, as hospitals attempted to increase patient throughput. Finally, it would also be interesting to examine other policy alternatives towards shortening elective care waiting lists whilst doing so with high quality. For instance, could it be that the sanctions (and

incentives) ought to not only target hospitals but also include the primary care physicians doing the referrals so as to curb undesirable behavior (e.g. inadequately referring patients for hospital treatment)? Alternatively, could it be that patients would be willing to wait longer if it meant that they could be treated at a more reputable hospital? Ultimately, the importance of this future work would then be in examining the 18 Weeks policy with a multidimensional performance construct, while bringing to light the adverse implications of its original construct, and exploring potential solution not only within an individual hospital's boundary but also across the service architecture.

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Appendices

Appendices

Appendix I: Detailed Literature Review Supporting Lean Enterprise Principles

Reference	1	2	3	4	5	6	7	Paper	Note
(March, Simon et al. 1958)		X						Org theory	"When we describe the chief participants of most business organizations, we generally limit our attention to the following five major classes: employees, investors, suppliers, distributers, and consumers"
(Drucker 1963)			X					Strategy	"What is the major problem? It is fundamentally the confusion between effectiveness and efficiency that stands between doing the right things and doing things right. There is surely nothing quite so useless as doing with great efficiency what should not be done at all. Yet our tools--especially our accounting concepts and data -- all focus on efficiency. What we need is (1) a way to identify the areas of effectiveness (of possible significant results), and (2) a method for concentrating on them" "every analysis of actual allocation of resources and efforts in business that I have ever seen or made showed clearly that the bulk of time, work, attention, and money first goes to "problems" rather than to opportunities, and, secondly, to areas where even extraordinarily successful performance will have minimal impact on results."
(Perrow 1967)	X				X			Org theory	[1] "attempts to conceptualize the organization as a whole, rather than to deal only with specific processes or subpart" [5] "The other relevant characteristic of the raw material, besides the understandability of its nature, is its stability and variability; that is, whether the material can be treated in a standardized fashion or whether continual adjustment to it is necessary. Organizations uniformly seek to standardize their raw material in order to minimize exceptional situations."
(Herzberg 1968)							X	Management	"The only way to motivate the employee is to give him challenging work in which he can assume responsibility. [...] Removing some controls while retaining accountability. Increasing the accountability of individual for own work. Granting additional authority to an employee in his activity [...] Introducing new and more difficult tasks not previously handled. Assigning individuals specific or specialized tasks, enabling them to become experts"
(Skinner 1969)			X					Manufacturing	"The connection between manufacturing and corporate success is rarely seen as more than the achievement of high efficiency and low costs. [...] Few top managers are aware that what appear to be routine manufacturing decisions frequently come to limit the corporation's strategic options, binding it with facilities, equipment, personnel, and basic controls and policies to a noncompetitive posture which may take years to turn around."

Reference	1	2	3	4	5	6	7	Paper	Note
(Miles, Snow et al. 1974)		X						Org theory	"the organization cannot unilaterally choose its domain. There must be some degree of consensus among those with whom the organization comes into contact-either resource providers or critics of the organization's proposed activities-regarding the desired arena of activity, and this process of attaining domain consensus frequently constrains what activities the organization undertakes"
(Etzioni 1975)						X		Org theory	P218/219 ""The explosive energy created by a nonconformist leader, recruiting followers to a cause at odds with the organization, is highly threatening to the organization's stability and routine, and in some instances to its continued viability. By the same token, the moral involvement sparked by allegiance to a charismatic leader can, when the leader is committed to the organization, provide the strongest possible bond linking lower participants to organizational goals" P231 "In organizations the higher ranks tend to support the cultural system; participants lower in rank vary widely in their orientation to it""
(Shortell 1976)		X						Healthcare	"Currently, there appears to be a general demand for greater organizational responsiveness and accountability, but little recognition that these demands frequently come from different groups with varying notions of accountability, often placing the organization in the position of having to reconcile incompatible objectives."
(Sugimori, Kusunoki et al. 1977)		X			X			Lean	[2] "a system of respect for human, putting emphasis on the points as follows: (1) elimination of waste movements by workers; (2) consideration for workers' safety; and (3) self-display of workers' capabilities by entrusting them with greater responsibility and authority." [5] "Leveling of production: Provided that all processes perform small lot production and conveyance, if the quantity to be withdrawn by the subsequent process varies considerably, the processes within the company as well as the subcontractors will maintain peak capacity or holding excessive inventory at all times."
(Hayes and Abernathy 1980)	X							Management	"guided by what they took to be the newest and best principles of management, American managers have increasingly directed their attention [to] short-term cost reduction rather than long-term development of technological competitiveness" "their devotion to short-term returns and 'management by the numbers,' many of them have effectively forsworn long-term technological superiority as a competitive weapon. In consequence, they have abdicated their strategic responsibilities." "the predictable result of relying too heavily on short-term financial measures – a sort of managerial remote control – is an environment in which no one feels he or she can afford a failure or even a momentary dip in the bottom line." "It may provide a quick, short-term boost to ROI figures in the next annual report,

Reference	1	2	3	4	5	6	7	Paper	Note
									but it may also paralyze the long-term ability of a company to keep on top of technological change."
(Van de Ven and Ferry 1980)		X						Org theory	"a measurement of performance does not require that different people agree on effectiveness goals, criteria, and standards. Consensus may in fact be an unrealistic euphemism to attempt to achieve. An organization assessment simply requires that the unique and conflicting definitions of performance be made explicitly and that the organization analyst determine at the outset whose value judgments and criteria will be operationalized and measured."
(Iii and Leifer 1983)				X				Org theory	"Work units typically are expected to accomplish a number of different tasks that may vary in terms of their complexity and predictability. At the same time, they must cope with an internal environment-for example, other work units-as well as with external environmental factors such as government regulations, suppliers, and technological changes. It seems unlikely that a single structure would be capable of effectively handling this complex array of factors, all of which must be dealt with simultaneously."
(Shrivastava 1983)							X	Org theory	"It is useful to distinguish between various levels at which learning occurs in systems. Cantley and Sahal (1980) identify five hierarchical levels of learning in socio-technical systems, comprising of: (a) the unit level (individual or single equipment), (b) the plant level, (c) the organizational or company level, (d) the industry level, and (e) the societal level." "Organizational learning is an organizational process rather than an individual process. Although individuals are the agents through whom the learning takes place, the process of learning is influenced by a much broader set of social, political, and structural variables. It involves sharing of knowledge, beliefs, or assumptions among individuals."
(Freeman 1984)		X						Org theory	"A stakeholder is any group or individual who can affect or is affected by the achievement of the organization's objectives"
(Schein 1985)						X		Org theory	P5 "the only thing of real importance that leaders do is to create and manage culture; that the unique talent of leaders is their ability to understand and work with culture"
(Skinner 1986)			X					Manufacturing	"The very way managers define productivity improvement and the tools they use to achieve it push their goal further out of reach." "Chipping away at productivity… is mostly concerned with direct labor efficiency, although direct labor costs exceed 10% of sales in only a few industries. Thus even an immense jump in productivity – say 20% - would not reverse the [problems of various

Reference	1	2	3	4	5	6	7	Paper	Note
									industries]" "An obsession with cost reduction produces a narrowness of vision and an organizational backlash that work against its underlying purpose."
(Donabedian 1988)	X		X					Healthcare	"It is not intended to identify wrongdoers but to promote the effectiveness of the whole. It does so by focusing on important problems amenable to improvement."
(Drucker 1989)			X					Strategy	"Starting with the mission and its requirements may be the first lesson business can learn from successful nonprofits. [...]It alone can prevent the most common degenerative disease of organizations, especially large ones: splintering their always limited resources on things that are "interesting" or look "profitable" rather than concentrating them on a very small number of productive efforts"
(Fawcett 1989)	X							Lean	Japanese auto manufacturers favor long-term considerations over short-term profitability.
(Fry and Cox 1989)	X		X					Performance measurement	[1,3] "The use of local productivity measures to direct the long-term success of the organization must be eliminated; an organization's success can only be assured by concentrating on global system-wide performance." [1,3]"...we recommend studying the impact of these measures on other functional areas and production departments. Measures should be synchronized from vendor to customer, from short run to long run, and from operational measures through tactical to strategic advantages."
(Ragin 1989)	X			X				Research method	P24 "Parts are not viewed in isolation but in context of the whole they form. To change one or more elements often changes how the whole is perceived or understood, which, in turn, has an impact on the meaning of each individual part"
(Berwick 1989)		X						Healthcare	"Few can improve without the help of the medical staff."
(Venkatraman 1989)	X							Strategy	Quote (Miller and Friesen 1977) "There is something holistic and ordered about the pattern of attributes" and note that "such a pattern could provide useful insights into a powerful concept of equifinality or the feasible sets of internally consistent and equally effective configurations."
(Tsui 1990)	X			X				Performance measurement	"Based on the open-systems logic, subunits within organizations may be conceived of as micro-organizations that must adapt to their environment for survival. The elements in this environment may consist of other formal subunits and informal groups inside the organization, as well as elements in the larger organization's external environment."
(Wisner and Fawcett 1991)	X		X					Performance measurement	[1, 3] "By focusing on the short-term efficiency information produced by traditional measurement systems, opportunities to improve competitiveness are overlooked. For

Reference	1	2	3	4	5	6	7	Paper	Note
									example, a typical response to increased competitive pressure is a directive to "cut costs", often resulting in decision to reduce capital investment, minimize research and development, cut back on preventive maintenance, and lay-off workers. Each of these decisions may reduce the firm's long-term competitiveness. Therefore, the development of an overall performance measurement system that directs the firm's productive resources to enhance its value-adding capabilities is needed."
(Meyer, Tsui et al. 1993)	X							Org theory	"Organizational structures and management systems are best understood in terms of overall patterns rather than in terms of analyses or narrowly drawn sets of organizational properties." "the holistic nature of organizational phenomena. It is the patterning of organizational elements that should be the focus of inquiry rather than bivariate [analysis]"
(Ostroff and Schmitt 1993)			X					Org theory	"Although the best- performing organizations are both effective and efficient [...] there may be trade-offs between the two" "Efficient but ineffective organizations were characterized by a greater emphasis on structural context, goals, and rules, a pattern consistent with the rational goal and open systems models. Although these features may contribute to efficiency, the overemphasis on structure, control, and cost minimization can diminish energy, trust, and morale and hence reduce the effectiveness of an organization."
(Peters and Heron 1993)		X						Best practice theory	"The social validity of a proposed best practice should be assessed as a means to evaluate the acceptability or viability of an intervention."
(Drucker 1994)	X			X		X		Strategy	[1, 4] "The assumptions about environment, mission, and core competencies must fit reality. [...]The assumptions in all three areas have to fit one another" [6] "The theory of the business must be known and understood throughout the organization." [6] "Traditionally, we have searched for the miracle worker with a magic wand to turn an ailing organization around. To establish, maintain, and restore a theory, however, does not require a Genghis Khan or a Leonardo da Vinci in the executive suite. It is not genius; it is hard work. It is not being clever; it is being conscientious. It is what CEOs are paid for."
(Fjortoft and Smart 1994)						X		Org theory	"Mission agreement refers to the level of consensus that exists among organizational members regarding their view of the purpose of the institution, while mission consistency refers to the congruence between institutional activities and the espoused mission. Both of these elements of institutional mission have been found consistently to be related to the effective performance" "organizational culture may be created and influenced through such specific behaviors as

Reference	1	2	3	4	5	6	7	Paper	Note
									what leaders pay attention to on a regular basis, how leaders react to critical incidents, what criteria leaders use to allocate resources, and the qualities of individuals who are recruited by and promoted in the organization." "well crafted mission statements alone are insufficient to promote effective performance; equal attention must be devoted to assure that the actual programs and activities of institutions are consistent with their stated missions."
(Flood 1994)		X						Healthcare	"a hospital needs to attract and retain clients. Broadly speaking, 'clients' can include patients (receiving inpatient care, same-day surgery, or outpatient care) who may consider amenities and price in addition to quality; physicians (typically not employees and not committed to one hospital, and perhaps attracted by convenience or special facilities); and insurers seeking special prices in return for encouraging patients to use the particular hospital"
(Womack and Jones 1994)		X	X	X				Lean	[4] "[lean enterprise] will entail radical changes in employment policies, the role of functions within companies, and the relationships among the companies of a value stream. Managers will have to concentrate on the performance of the enterprise rather than on the performance of individual people, functions, and companies." [2, 4] "Unfortunately, industrial history is replete with stories of companies that have used their leadership positions to extract advantage from upstream and downstream partners." [2,3,4] "Getting managers to think in terms of the value stream is the critical first step to achieving a lean enterprise. Managers who have taken this first step, however, have often run into stiff resistance from employees and functional units as well as from other companies in the stream. Individuals, functions, and companies have legitimate needs that conflict with those of the value stream. Anyone aspiring to a lean enterprise must first understand these needs and bow to satisfy them."
(Clarkson 1995)		X						Stakeholder theory	"corporations manage relationships with stakeholder groups rather than with society as a whole" "it is important to distinguish between social issues and stakeholder issues" "all the corporations being studied had relationships with various groups or constituencies, which could be defined as stakeholder groups, and that these relationships were either being managed, or not being managed, for better or worse. Whether these groups of customers, employees, shareholders, etc., were classified as internal or external stakeholders was irrelevant, just as it was irrelevant for the companies themselves whether these groups were described as stakeholders at all."
(Denison and						X		Org theory	"As many organizations have discovered, declaring a new organizational mission does not necessarily imply the support and commitment of organizational members, and high

Reference	1	2	3	4	5	6	7	Paper	Note
Mishra 1995)									involvement among an organization's members does not necessarily imply a clear sense of direction."
(Drucker 1995)				X				Strategy	"The command-and-control organization that first emerged in the 1870s might be compared to an organism held together by its shell. The corporation that is now emerging is being designed around a skeleton: information, both the corporation's new integrating system and its articulation."
(Neely, Gregory et al. 1995)	X		X					Performance measurement	[1] "One prime reason for the marketing/manufacturing conflict is that the two functions are evaluated on the basis of different criteria and receive rewards for different activities. On the one hand, the marketing people are judged on the basis of profitable growth of the company in terms of sales, market share, and new markets entered. Unfortunately, the marketers are sometimes more sales-oriented than profit-oriented. On the other hand, the manufacturing people are often evaluated on running a smooth operation at minimum cost. Similarly unfortunately, they are sometimes more cost-oriented than profit-oriented." [3] "Take, for example, Nissan, where the espoused business strategy is "to build profitably the highest quality car sold in Europe". If Nissan's purchasing manager were to decide independently to buy low-cost, low-quality components then Nissan could end up following a strategy radically different to the one it had planned to adopt." [3] "Effectiveness refers to the extent to which customer requirements are met, while efficiency is a measure of how economically the firm's resources are utilized when providing a given level of customer satisfaction. This is an important point because it not only identifies two fundamental dimensions of performance, but also highlights the fact that there can be internal as well as external reasons for pursuing specific courses of action"
(Grant 1996)		X		X			X	Org theory	"Viewing the firm's primary task as integrating the specialized knowledge of multiple individuals suggests that, even with goal congruence, achieving effective coordination is problematic for organizations."
(Porter 1996)	X		X	X	X	X		Strategy	[1] "A competitor seeking to match an activity system gains little by imitating only some activities and not matching the whole. Performance does not improve; it can decline" [3] "The pursuit of operational effectiveness is seductive because it is concrete and actionable. [...]Caught up in the race for operational effectiveness, many managers simply do not understand the need to have a strategy." [3] "Constant improvement in operational effectiveness is necessary to achieve superior profitability. However, it is not usually sufficient. Few companies have competed successfully on the basis of operational effectiveness over an extended period, and staying ahead of rivals gets harder every day."

Reference	1	2	3	4	5	6	7	Paper	Note
									[3] "While operational effectiveness is about achieving excellence in individual activities, or functions, strategy is about combining activities" [4] "Competitive advantage arises from fit across activities" [4,5] "Continuity fosters improvements in individual activities and the fit across activities, allowing an organization to build unique capabilities and skills tailored to its strategy. Continuity also reinforces a company's identity." [continuity used similarly to stability] [5] "Strategic continuity, in fact, should make an organization's continual improvement more effective." [6] "The challenge of developing or reestablishing a clear strategy is often primarily an organizational one and depends on leadership."
(Womack and Jones 1996)	X			X	X		X	Lean	[1] "While thousands of companies worldwide have been engaged in the Lean transformation for five to ten years or more, most have achieved only modest levels of improvement – typically in only one part of the business such as operations" [4] The value stream: identify every step needed for each product family and eliminate waste whenever a step doesn't create value. [5] Flow: value creating steps should take place in tight sequence so that value flows smoothly to the customer. [7] Perfection: lean is a never ending process which continuously seeks perfection through the elimination of waste so that every value stream step creates value.
(Worley, Hitchin et al. 1996)	X			X				Org theory	""both short term and long term performance requires executives to manage external and internal considerations simultaneously and to comprehend both the challenges in the marketplace and those within their organizations."
(Grant 1997)		X		X			X	Org theory	[2,7] "agency theory and much management theory view firms as owned and controlled by their stockholders, where the fundamental management problem is how to align the objectives of managers and workers with those of the owners. The knowledge-based view suggests that, if knowledge is the preeminent productive resource, and most knowledge is created by and stored within individuals, then employees are the primary stakeholders. The principal management challenge is not reconciling divergent goals, but establishing the mechanisms by which cooperating individuals can coordinate their activities in order to integrate their knowledge into productive activity." [4] "The principles of knowledge management can play an important role in optimizing the design of such modular systems. A key distinction here is between the 'component knowledge' required by the sub-systems and the 'architectural knowledge' required for the linking of the various sub-systems"

Reference	1	2	3	4	5	6	7	Paper	Note
									[7] "Total quality management is a non-hierarchical, team-based organizing technology that permits an organization to access and utilize individuals' knowledge located at low levels of the organization."
(Hauser and Katz 1998)			X					Performance measurement	"Pitfall 7. Thinking too narrowly [...] But why do we need a telephone service center in the first place? What if we designed our products so that they were so easy to use that customers never needed to call our service center?"
(Lockamy Iii and Spencer 1998)	X		X					Performance measurement	[1, 3] "many of these articles focused on the local optimization of the functional area with little regard for how either other functions or the business unit itself may be impacted."
(Nancy 1999)	X							Lean	"In the global race for higher quality, faster delivery, and lower costs, your company will not stand a chance against the competition if your idea of running a lean business extends no further than the factory floor."
(Hauser 2001)						X		Management	"A critical role of central management is to establish and foster a culture that motivates and rewards product development teams to allocate the right amount of effort toward achieving those metrics."
(Richard and Amy 2001)					X	X	X	Org learning	[5,7] "Teams that learned rapidly deliberately required stability of both the teams and the operating room processes as they gained initial experience with the new technology." [6,7] "local leaders can facilitate learning-in-action by inviting input, asking questions, acknowledging their own infallibility, and challenging everyone to strive for continuous improvement. In both of our studies, the behavior of the team leader set the learning climate for the team. Moreover, team leaders have to communicate the need and the opportunity for learning-especially in the case of double-loop learning opportunities-as individual practitioners have been trained to address these shortfalls in a reactionary way. Senior leaders can also set an agenda of system reform." [6,7] "First, leaders must recognize the need for collective learning, rather than just individual-based learning, and they must help institute structures and processes that encourage it. Second, leaders must help to create and nurture organizational cultures in which learning can occur-that is, in which human fallibility is understood as a fact of life and the climate is psychologically safe for admissions of ignorance and error. Third, those in positions of leadership at the local level-of an operating room team, or a patient care unit, for example-must lead learning by example."
(Carroll and Edmondson 2002)				X	X	X	X	Org learning	[4] "Leaders are more effective when they take a broad view of the interdependencies among individuals, teams, task flows, systems, and cultural meanings." [5,7] "Healthcare organisations are adept at local learning, but many practitioners resist standards and guidelines at the organisational level as infringements on their professional

Reference	1	2	3	4	5	6	7	Paper	Note
									standing. Standardisation also can drive out innovation. Even the best teaching hospitals have ad hoc work practices that vary from department to department and tend to lionise surgeons who exemplify the individualistic culture. However, the kind of standardisation that is needed is not telling surgeons how to operate, but rather developing systems of communication and work practices that ensure that patients get the right drug at the right time, the right test at the right time, and that the right kinds of conversations are encouraged to support feedback and discovery." [6] "Just as safety is a property of a system rather than solely the result of individual skill, leadership is also a system property. In a time of rapid changes in technology, demographics, markets, and organisation forms, leadership is an essential function to prepare and mobilise organization participants for change [..]Mention of "the leader" should not, however, be taken to mean the CEO or other executives. Leadership must be distributed broadly if organisations are to increase their capacity for learning and change and therefore to flourish in a complex and changing environment. Specifically, we discuss executive or strategic leadership at the top of an organisation, line leadership from managers in the middle, and informal or network leadership from individuals throughout the organisation." [7] "Organisational learning is a process of increasing the capacity for effective organisational action through knowledge and understanding"
(Drucker 2002)						X		Management	"Executives will have to learn what the effective department head in the university or the successful conductor of the symphony orchestra have long known: The key to greatness is to look for people's potential and spend time developing it. To build an outstanding university department requires spending time with the promising young postdocs and assistant professors until they excel in their work. To build a world-class orchestra requires rehearsing the same passage in the symphony again and again until the first clarinet plays it the way the conductor hears it. This principle is also what makes a research director in an industry lab successful."
(Inamdar and Kaplan 2002)			X			X		Performance measurement	Suggest as core principles that organizations should: [3]"Translate the strategy into operational terms"; [6] "Align the organization to the strategy"; "Make strategy a continual process"; and "Mobilize change through executive leadership"
(Murman, Allen et al. 2002)	X	X	X	X				Lean	[1] Fully realize lean value only by adopting an enterprise perspective [2] Deliver value only after identifying stakeholder value and constructing robust value propositions [3] Create lean value by doing the right job right and by doing the right job [4] Address the interdependencies across enterprise levels to increase lean value

Reference	1	2	3	4	5	6	7	Paper	Note
(Nightingale 2002)	X		X	X	X			Systems thinking	[1,3,4,5] "To create value efficiently, various elements of any enterprise - processes, information, organizations, and enabling infrastructure - need to be appropriately linked and integrated. There is a great tendency for organizations to function as a group of 'silos', with each sub-unit (for example, procurement or engineering) acting independently of the other sub-units. Often, sub-unit performance excels, but the enterprise as a whole fails to achieve its full potential. It is important to understand what elements require full integration vs. interfacing and/or effective communication flow."
(Needy, Norman et al. 2002)		X						Lean	"Companies often make broad statements claiming that people are their greatest assets. Upon closer examination of the practices of these companies, one often finds that the company pays lip service with this statement. Companies that value human capital often fall short when systematically assessing it"
(Benner and Tushman 2003)		X		X				Org theory	[2,4] "Customers include not only external consumers of the organization's products or services but also a series of internal recipients at linkage points between processes, as outputs from upstream processes become the inputs for subsequent processes." [4] "The process revolution has been marked by a shift from the view of organizations as a collection of departments with separate functions and outputs to a view of them as systems of inter- linked processes that cross functions and link organizational activities"
(Rouse and Putterill 2003)		X						Performance measurement	"Stakeholders include owners, employees, partners (just-in-time suppliers and customers), and the community. Their requirements and expectations define the environment and general constraints that the organisation must recognise in its operations" "Organization goals embody the vision or mission, which are expressions of its response to stakeholder expectations and requirements." "Much of the recent work in performance measurement has argued that stakeholder expectations encompass both financial and non-financial dimensions of the organisation."
(Bazzoli, Dynan et al. 2004)		X						Healthcare	"we define value to include efficiency and financial performance because these are important to shareholders of for-profit health organizations and also to managers and trustees of nonprofit health firms. Value also encompasses the benefits derived by consumers in the marketplace, including access to care, cost effectiveness, quality, and satisfaction. Other players in the market could derive value from organizational change, including physicians who may receive better administrative service or financial support as their affiliated hospitals undertake certain changes or health plans that are better able to transfer risk to a restructured health organization"
(Liker 2004)	X	X			X	X	X	Lean	[1] "Principle 1. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals."

Reference	1	2	3	4	5	6	7	Paper	Note
									[2] "Principle 11. Respect your extended network of partners and suppliers by challenging them and helping them improve." [2] "Generate value for the customer, society, and the economy—it is your starting point. Evaluate every function in the company in terms of its ability to achieve this." [5] "Principle 2. Create a continuous process flow to bring problems to the surface. Redesign work processes to achieve high value-added, continuous flow. Strive to cut back to zero the amount of time that any work project is sitting idle or waiting for someone to work on it. Create flow to move material and information fast as well as to link processes and people together so that problems surface right away. [...]Make flow evident throughout your organizational culture. It is the key to a true continuous improvement process and to developing people." [5] "Principle 6. Standardized tasks and processes are the foundation for continuous improvement and employee empowerment. Use stable, repeatable methods everywhere to maintain the predictability, regular timing, and regular output of your processes. It is the foundation for flow and pull." [5] "Create a strong, stable culture in which company values and beliefs are widely shared and lived out over a period of many years. Train exceptional individuals and teams to work within the corporate philosophy to achieve exceptional results. Work very hard to reinforce the culture continually." [5] "Make flow evident throughout your organizational culture. It is the key to a true continuous improvement process and to developing people." [5] "Protect the organizational knowledge base by developing stable personnel, slow promotion, and very careful succession systems." [6] "Principle 9. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others. Grow leaders from within, rather than buying them from outside the organization. Do not view the leader's job as simply accomplishing tasks and having good people skills. Leaders must be role models of the company's philosophy and way of doing business. A good leader must understand the daily work in great detail so he or she can be the best teacher of your company's philosophy." [7] "On a daily basis, engineers, skilled workers, quality specialist, vendors, team leaders, and—most importantly—operators are all involved in continuous problem solving and improvement, which over time trains everyone to become better problem solvers." [7] "Principle 14. Become a learning organization through relentless reflection (hansei) and continuous improvement (kaizen). Once you have established a stable process, use continuous improvement tools to determine the root cause of inefficiencies

Reference	1	2	3	4	5	6	7	Paper	Note
									and apply effective countermeasures."
(Roos, de Neufville et al. 2004)	X	X						Systems thinking	[1] "System architecture and design of next generation infrastructure require a holistic, enterprise wide perspective rather than the reductionist top-down approach of traditional engineering design." [2] "Evaluative complexity occurs because the multiple stakeholders who are involved with or impacted by the infrastructure systems have different perspectives. Each stakeholder has a different objective function and different values, so it is difficult (some would say impossible) to generate a solution that satisfies all stakeholders"
(Barki and Pinsonneault 2005)				X				Org theory	"In addition, OI [Organizational Integration] is reflected by responsiveness, i.e., interdependent organizational components rapidly and adequately responding, adjusting, or adapting to the demands of other components. [...] when the sales of a product increase unexpectedly, a responsive production and operations department will rapidly adjust its output to the new requirements." "A distinction can be made between the integration of the processes that are internal to an organization and those that are external"
(Becker 2005)					X		X	Org theory	[5,7] "The stability that recurrent interaction patterns provide plays an important role for learning: it enables learning by providing a stable baseline against which to assess feedback, compare and draw implications. Recurrent interaction patterns provide a baseline against which to compare, and, more generally speaking, to learn. Where such a baseline does not exist, drawing inferences is difficult. Where the baseline changes rapidly, there is the risk of overreacting to noise and to foreclose the experimentation necessary to discover good alternatives. A stable baseline, therefore, is an important precondition for learning."
(Emiliani and Stec 2005)	X	X	X	X		X		Lean	[1] "Senior managers typically understand Lean as a 'manufacturing thing', and not as a comprehensive management system. Thus, the application of Lean principles and practices is limited to only a portion of the company's activities such as operations" [1] "It is common today among senior managers of publicly owned businesses to be focused on the short term. While most senior managers say they care a lot about the future of the company, they instead support business practices, metrics and behaviors that actually reduce competitiveness over time." [2] "The result of productivity improvement is often unemployment. This action undercuts the desire of the remaining people to participate in future improvement activities. Not surprisingly, the pace of improvement is greatly slowed." [2] "The 'respect for people' principle is the key to making the Lean management system work" [2] "Lean is a stakeholder-based system of management, not a management practice that

Reference	1	2	3	4	5	6	7	Paper	Note
									favors shareholders over all other stakeholders" [2] "Senior managers of many publicly owned businesses are obsessively focused on shareholders, and usually make decisions that come at the expense of other stakeholders such as employees, suppliers, or local communities. It is impossible to achieve a Lean transformation with shareholders as the singular focus. Instead, managers must balance the interests of key stakeholders" [1,3] "In most cases, Lean activities do not directly link to corporate strategy and goals. Kaizen is often applied haphazardly; fantastic improvements are achieved in activities that only provide "local" benefits, not system wide gains or benefits to its end-use customers" [4] "Supply chain. It is difficult for suppliers to practice Lean effectively if their customers do not. Applying Lean throughout a supply chain requires the sponsorship and participation of large buying organizations that correctly apply Lean principles and practices to their own internal activities" [6] "Every senior manager says they support Lean, but in reality most believe they should be doing other things, or claim they are too busy to get involved with continuous improvement activities – either as team leaders or as team members. The lack of personal participation in improvement activities sends the message that Lean implementation is the job of lower-level workers, and that senior managers do not have to get involved" [6] "senior managers often exhibit wasteful behaviors, while at the same time telling workers to eliminate waste. People notice this inconsistency, and silently question senior management's commitment to Lean."
(Reijers and Liman Mansar 2005)			X					Lean	"the application of these various [lean operations] best practices must be embedded within an overall vision"
(Liker and Morgan 2006)	X				X		X	Lean	[1] "Many manufacturing companies have learned the hard way that the isolated application of lean tools and techniques does not lead to sustainable improvement. The broader organizational culture of the firm separates the short-term improvements from the long-term lean enterprises. And, to be effective, lean thinking cannot stop at the shop floor." [5] "The foundation of the house needs to provide the overall stability on which just-in-time systems can be built and the system constantly adjusted by stopping to fix problems. [...]Stable, standardized processes are necessary, or just-in-time production will mean no production."

Reference	1	2	3	4	5	6	7	Paper	Note
									[5] "[JIT] relates to making material flow through processes very fast, getting the right part to the right place at the right time." [7] "Surfacing problems is only valuable if people working on the process have the tools and are motivated to first contain the problems and then solve them at the root cause. It is an endless journey of improvement." [7] "The journey is far more complex than applying a few tools or holding some classes. It truly is a cultural transformation. It truly is a PDCA learning process. You need to start on the learning journey and then keep going and never stop. You need to practice deep reflection and learn. Toyota is continually learning. They are far from perfect—and would become very nervous if anyone thought they were. What we can take away from Toyota is the importance of becoming a humble, learning organization."
(Folan, Browne et al. 2007)			X					Performance measurement	"[firms] regard localised, rather trivial statistics as being somehow intimately linked with their strategic directives [..] In this error, which is an error of trying to be too exacting with the general rule that suggests a casual hierarchical link between operational performance measures to strategic performance measures at a higher level, the performance measurement literature, it must be confessed, must take some blame as it seems to have popularised a general principle that can easily be perverted in practice."
(Bhasin 2008)						X		Lean	"In this context, policy deployment (or Hoshin) has become an acceptable method to communicate quality and productivity goals throughout a lean organisation. It is used by Toyota and leading western organisations such as Intel and Ford. The principle suggests that by communicating common objectives the organisation can secure commitment. The main stages look at the current state, the changes necessary and the vision or future state"
(Rhodes and Nightingale 2008)		X						Systems thinking	"While enterprise principles initially focused heavily on the client, more recent enterprise research has revealed that the critical success factor for today's enterprises is to balance the needs of all stakeholders. It is critical that these multiple stakeholder views and contributions to the enterprise be considered in its design to achieve desired performance objectives and deliver value."
(Valerdi, Nightingale et al. 2008)			X					Systems thinking	"the enterprise context may require stakeholders to suboptimize their organization for the sake of global optimization of the enterprise."
(Hussey, Eibner et al. 2009)		X						Healthcare	"All savings represent lost income for somebody, and affected stakeholders have successfully blocked, weakened, or circumvented past attempts at cost control."

Appendix II: Research Question 1 Interview Protocol and Quantitative Questionnaires

Research Question:
"How is hospital enterprise performance currently measured?"

Interview Protocol

Question Category	#	Description
Interviewee function	1	What is your role?
	2	What responsibilities do you have?
	3	How long have you been in the organization?
Mission and strategy	4	What is your hospital's mission?
	5	What is your hospital's strategic vision?
	6	Who are your key stakeholders?
	7	What are the key stakeholder expectations you strive to meet? Are these always in alignment? How so?
	8	How well do these stakeholders in turn meet your own expectations?
Performance definition and measurement	9	What is your definition of hospital enterprise performance?
	10	What performance dimension(s) do you consider?
	11	What are the key metrics that you use to assess overall hospital performance?
	12	What would constitute high or low hospital enterprise performance?
	13	How do you measure hospital enterprise performance?
	14	What are your performance improvement objectives?
Service units	15	Which service units contribute the most to your bottom line?
	16	Which service units perform better and why? Which ones have more room for improvement than others and why?
	17	How do you compare the performance across different service units?
Extended enterprise	18	How do you assess the performance of the interaction of your hospital with other healthcare providers?

Please assign relative weights to the performance dimensions using multiple pair wise comparisons. These performance dimensions are drawn from a longitudinal analysis of multiple bodies of literature addressing hospital performance measurement.

The intent is to determine the relative importance of each pair wise performance dimension comparison while addressing the question: "***How do I currently measure my hospital's performance?***"

Sample metrics for each performance dimension are provided on a separate sheet. Please note that the performance dimensions are in alphabetical order on the diagram.

Relative weight							Performance Dimension	No.
1 / 8	1 / 7	1 / 6	1 / 5	1 / 4	1 / 3	1 / 2	Customer Satisfaction	1
	2 / 8	2 / 7	2 / 6	2 / 5	2 / 4	2 / 3	Employee Satisfaction	2
		3 / 8	3 / 7	3 / 6	3 / 5	3 / 4	Equity (Social)	3
			4 / 8	4 / 7	4 / 6	4 / 5	Finance	4
				5 / 8	5 / 7	5 / 6	Operations	5
					6 / 8	6 / 7	Organizational Learning	6
						7 / 8	Quality	7
							Strategy / Operations Alignment	8

In the table below please assign relative weights to performance dimensions using simultaneous comparisons such that they all add to 100%.

Once again please conduct this exercise while addressing the question: "***How do I currently measure my hospital's performance?***"

Sample metrics for each performance dimension are provided on a separate sheet. Please note that the performance dimensions are in alphabetical order on the table.

Performance Dimension	**Relative Weight**
Customer Satisfaction	
Employee Satisfaction	
Equity (Social)	
Finance	
Operations	
Organizational Learning	
Quality	
Strategy / Operations Alignment	
Total	**100%**

No.	Performance Dimension	Metrics
1	Customer Satisfaction	Patient satisfaction. Patient likelihood to recommend provider in the future. Responsiveness to community expectations.
2	Employee Satisfaction	Absenteeism. Turnover. Employee tenure. Nurse and physician satisfaction.
3	Equity (Social)	Stratified measures in terms of age, gender, income, race, payer, etc.
4	Finance	Market share. Total operating margin. Return on assets. Cash flow to revenues ratio. Cost per discharge. Cost per patient day. Net patient revenues.
5	Operations	Length of stay. Bed occupancy. Number of ambulatory visits. Number of emergency visits. Number of inpatient days. Number of outpatient surgeries.
6	Organizational Learning	Training hours per employee. New technology investment. Employee development programs.
7	Quality	Mortality. Morbidity. Technical quality of care. Number of patient readmissions. Quality of interpersonal relationship with patient. Number of malpractice claims.
8	Strategy / Operations Alignment	Service unit consensus on goal priorities. Inter service unit cooperation.

Questionnaire 3: Performance Dimension: **Customer Satisfaction**

Metric used?	Metric rank?	Metric name	Metric formula
		Average time for complaint resolution	
		Patient intent in recommending facility in the future	Would you recommend this hospital to your friends and family?
		Patient satisfaction	Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?
		Responsiveness to community expectation	Evaluated by selected respondents from the community (EMT, police, fire department, health dept) with knowledge about or contact with each service unit.

Questionnaire 3: Performance Dimension: **Employee Satisfaction**

Metric used?	Metric rank?	Metric name	Metric formula
		Absenteeism	
		Average employee tenure	
		Employee satisfaction survey	Using any number from 0 to 10 where 0 is the least satisfied possible and 10 is the most satisfied possible, what number would you use to rate your satisfaction at this hospital?
		Incidence of non fatal occupation injuries and illnesses	[number of injuries and illnesses / total hours worked by all FTEs in a calendar year] x 200,000)
		Nursing turnover	
		Perceptual assessment of harmony in the service unit	
		Perceived professional autonomy	Perceived professional autonomy and opportunity to exercise meaningful influence over the work and the operation of the service unit on the part of the medical and nursing staff.
		Physician turnover	
		Staff safety in terms of excessive weekly working time.	
		Staff satisfaction with personal goal attainment	

Questionnaire 3: Performance Dimension: **Equity (Social)**

Metric used?	Metric rank?	Metric name
		Patient mix by geography
		Patient mix by payer group
		Percentage of staff from underrepresented groups
		Stratify all measures into subpopulations that differentiate by gender, age, income, or racial groupings.

Questionnaire 3: Performance Dimension: **Finance**

Metric used?	**Metric rank?**	**Metric name**	**Metric formula**
		Cash flow to total revenues ratio	[Net income (operating and non operating sources) + annual depreciation/amortization/interest expense] / total revenues
		Cost per discharge index	Total expenses (salary and equipment) / total number of discharges
		Cost per inpatient day	Total costs (salary and equipment) / total number of inpatient days
		Cost per patient visit	Total costs / total number of patient visits
		Market share	Total hospital patients days / total county patient days
		Proportion of payroll expense	Total salary cost / total operating expenses
		Proportion of inpatient care revenue	Net inpatient revenue / net total patient revenue
		Total operating margin	(total revenues - total costs) / total revenue
		Total operational expenses	
		Return on assets	Net income / total assets

Questionnaire 3: Performance Dimension: **Operations**

Metric used?	Metric rank?	Metric name	Metric formula
		Average length of stay	Total number of inpatients days / total number of discharges (including deaths)
		Number of ambulatory visits	
		Number of emergency visits	
		Number of inpatient days	
		Number of inpatient surgeries	
		Number of outpatient surgeries	
		Responsiveness of service unit interaction	Perceptual data from service unit managers on each other's response timeliness
		Service unit efficiency (discharge rate)	Total patients discharged for a given service unit / service unit # of beds
		% of emergency visit admissions	Admitted emergency patients / total emergency patients
		% bed utilization	Total patient days / (number of beds x 365 days)

Questionnaire 3: Performance Dimension: **Organizational Learning**

Metric used?	**Metric rank?**	**Metric name**	**Metric formula**
		Average training hours per employee	Total training hours for all employees / total employees
		Employee training expenditure	Direct cost for all activities dedicated to staff training / average number of FTE
		Proportion of employees with personalized development plans	Total employees with personalized development plans / total employees
		Proportion of new technology investment	Total new technology investments / net income

Questionnaire 3: Performance Dimension: **Quality**

Metric used?	Metric rank?	Metric name	Metric formula
		Effectiveness of clinical care (objective data)	Series of evidence based medicine process checks [e.g. % children immunised, % mammography in target population, etc
		Mortality ratio per type of procedure	Total number of deaths per type of procedure / total number of patients per type of procedure
		Number of complications and/or adverse events	Post operative infections, post operative hemorrhage, nosocomial pneumonia, etc
		Quality of inter personal relationship with patient (e.g. privacy, confidentiality, informed choice, empathy, honesty, tact, sensitivity)	As perceived by nursing staff, physician staff, and by patients themselves
		Patient time spent waiting (e.g. in ED)	
		Physician perception of technical medical care quality	Hospital physicians from other service units rated the quality of medical care in the service unit under study
		Rate of patient readmission (within 30 days of previous discharge)	Total number of readmissions / total number of patients discharged
		Registered nurse perception of medical care quality	Registered nurses rating of the quality of medical management patients receive in service unit under study
		Specialist appointment wait time	Average waiting time for a patient to have a specialist appointment
		Total malpractice claims	

Questionnaire 3: Performance Dimension: **Strategy / Operations Alignment**

Metric used?	**Metric rank?**	**Metric name**	**Metric formula**
		Balanced physician incentives	Detect overuse or underuse of specific procedures, pharmaceuticals, etc per physician
		Perceptual assessment of cooperation with other service units in the hospital.	
		Staff consensus on goal priorities for each service unit.	

Appendix III: Organizational Learning Capability Scales

Organizational Learning Survey Scale (Goh and Richards 1997)

Dimension	Scale Item	Description
Clarity of Purpose and Mission	1	There is widespread support and acceptance of the organization's mission statement.
	2	I do not understand how the mission of the organization is to be achieved
	3	The organization's mission statement identifies values to which all employees must conform.
	4	We have opportunities for self assessment with respect to goal attainment.
Leadership Commitment and Empowerment	5	Senior managers in this organization resist change and are afraid of new ideas
	6	Senior managers and employees in this organization share a common vision of what our work should accomplish.
	7	Managers in this organization can accept criticism without becoming overly defensive.
	8	Managers in this organization often provide useful feedback that helps to identify potential problems and opportunities.
	9	Managers in this organization frequently involve employees in important decisions.
Experimentation	10	I can often bring new ideas into the organization.
	11	From my experience, people who are new in this organization are encouraged to question the way things are done.
	12	Managers in this organization encourage team members to experiment in order to improve work processes.
	13	Innovative ideas that work are often rewarded by management.
	14	In my experience, new ideas from employees are not treated seriously by management
Transfer of Knowledge	15	I often have an opportunity to talk to other staff about successful programs or work activities in order to understand why they succeed.
	16	Failures are seldom constructively discussed in our organization
	17	New work processes that may be useful to the organization as a whole are usually shared with all employees.
	18	We have a system that allows us to learn successful practices from other organizations.
Teamwork and Group-Problem Solving	19	Current organizational practice encourages employees to solve problems together before discussing them with a manager.
	20	We cannot usually form informal groups to solve organizational problems
	21	Most problem solving groups in this organization feature employees from a variety of functional areas.

The Organizational Learning Capability Scale (Jerez-Gómez, Céspedes-Lorente et al. 2005)

Dimension	Scale Item	Description
Managerial Commitment	1	The managers frequently involve their staff in important decisionmaking processes.
	2	Employee learning is considered more of an expense than an investment.
	3	The firm's management looks favorably on carrying out changes in any area to adapt to and/or keep ahead of new environmental situations.
	4	Employee learning capability is considered a key factor in this firm.
	5	In this firm, innovative ideas that work are rewarded.

Systems Perspective	6	All employees have generalized knowledge regarding this firm's objectives.
	7	All parts that make up this firm (departments, sections, work teams, and individuals) are well aware of how they contribute to achieving the overall objectives.
	8	All parts that make up this firm are interconnected, working together in a coordinated fashion.
Openness and Experimentation	9	This firm promotes experimentation and innovation as a way of improving the work processes.
	10	This firm follows up what other firms in the sector are doing, adopting those practices and techniques it believes to be useful and interesting.
	11	Experiences and ideas provided by external sources (advisors, customers, training firms, etc.) are considered a useful instrument for this firm's learning.
	12	Part of this firm's culture is that employees can express their opinions and make suggestions regarding the procedures and methods in place for carrying out tasks.
Knowledge Transfer and Integration	13	Errors and failures are always discussed and analyzed in this firm, on all levels.
	14	Employees have the chance to talk among themselves about new ideas, programs, and activities that might be of use to the firm.
	15	In this firm, teamwork is not the usual way to work.
	16	The firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learnt in past situations to remain valid, although the employees are no longer the same.

The Organizational Learning Capability Scale (Hult and Ferrell 1997)

Dimension	**Scale Item**	**Description**
Team Orientation	1	Cross-functional teamwork is not a common practice here
	2	Individuals in teams are often defensive about their particular functional specialty?
	3	A team spirit pervades our ranks.
	4	Around here, cross-functional teamwork is the common way of working rather than an exception to the norm.
	5	Measurement and reward systems are linked to team achievements, not just individual achievements
	6	There is a commonality of purpose in the purchasing process
	7	There is total agreement on our organizational vision across all levels, functions and divisions of the purchasing process.
	8	The purchasing department is committed to sharing their vision for the purchasing process with our SBU.
Systems Orientation	9	As our SBU representative, I have a good sense of the interconnectedness of all parts of the purchasing process
	10	As our SBU representative, I understand the purchasing process' basic value chain and how my work fits into that chain
	11	All activities that take place in the purchasing process are clearly defined.
	12	As our SBU representative, I understand where all activities fit-in in the purchasing process
	13	As our SBU representative, I am always attempting to develop new ways of looking at the purchasing process
Learning Organization	14	As our SBU representative, I am committed to the goals of this purchasing process
	15	As our SBU representative, I basically agree that our ability to learn is the key to

		improvement in the purchasing process.
	16	The basic values of this purchasing process include learning as a key to improvement
	17	The collective wisdom involved in the purchasing process is that once we quit learning, we endanger our future
	18	The sense around here is that employee learning is an investment, not an expense
	19	Learning in my SBU is seen as a key commodity necessary to guarantee efficiency of the purchasing process
Memory Orientation	20	As our SBU representative, I have specific mechanisms for sharing lessons learned in the purchasing process from project to project (unit to unit, team to team)
	21	As our SBU representative, I always audit unsuccessful purchasing endeavors and communicate the lessons learned widely
	22	There is a good deal of organizational conversation which keeps alive the lessons learned from history.
	23	We have formal routines that we use to uncover faulty assumptions that we may have made about the purchasing process.

Appendix IV: Hospital XYZ Additional Resources

i. Sample chief complaints per patient acuity severity index

The table below contains a sample of Chief Complaints associated to each patient acuity severity index. The acuity severity scale ranges from 1 to 5. A level 1 patient is the most severe and consists of a trauma patient who needs immediate attention so as to preserve life and avoid loss of any potentially endangered limb. Levels 4 and 5 are considered minor injury patients, whereas levels 2 and 3 although in a more serious condition, although not as serious as a level 1.

Sample chief complaints per patient acuity severity index

Patient Acuity Severity Index	Chief Complaint
5	Toe infection
	Suture removal
	Scratched eye lid
	Rash on hands
	Medication refill
4	Right knee injury
	Pulled groin
	Lower back pain
	IV antibiotics
	Finger laceration
3	Vomiting blood
	Severe abdominal pain
	Rectal bleeding
	Kidney stone
	Back pain
2	Suicidal
	Shortness of breath
	Severe chest pain
	Fever and disorientation
	Blood clot in right lung
1	Stroke
	Motor vehicle crash
	Cardiac arrest
	Brain attack
	Bicycle accident / hit head

ii. Estimating inpatient revenues

In 2006, as well as at the time of writing this thesis, three broad main categories of payment systems were in place to reimburse US hospitals for their rendered inpatient services. Notably, at any one time, hospitals will operate on multiple of these systems, depending on the payer organizations they hold contracts with.

- Capitation: The first category is capitation whereby a hospital is paid a fixed amount per patient per month, regardless of any costs incurred while treating capitated patients in either outpatient or inpatient settings. The set amount is negotiated between hospitals and private insurance companies.
- Medicare DRG: The second category is the prospective payment system used by Medicare, whereby hospitals are reimbursed a fixed amount for inpatient services based on Diagnostic Related Groups (DRGs), and regardless of any costs incurred while treating patients. Hospitals receive a single payment for all the services provided, based on the specific DRG assigned to a patient after discharge. The fixed amount per DRG is set by Medicare and isn't open to negotiation.
- FFS: The third category, is similar to the previous category, but is more generally referred to as the fee-for-service (FFS) model, whereby hospitals negotiate with private insurance companies a fee schedule for each of the services that they provide.

In terms of Medicare payments, a series of adjustments are applied for each hospital provider in particular. These include:

- Hospital is recognized for serving a disproportionate share of low-income patients
- Hospital is an approved teaching hospital which facilitates Indirect Medical Education (IME). Hospital XYZ had an adjustment factor of 6.7%, meaning that each Medicare payment was added 6.7%
- Hospital used a new specific technology for the specific case
- Hospital wage index
- Hospital geographic adjustment factor

In 2006, Medicare, and private insurance companies, had a policy whereby hospitals weren't reimbursed for their outpatient services if a particular patient was admitted afterwards within 72 hours. As such, when an ED decided to admit a patient, the ED services weren't billed separately, and instead were considered part of the DRG inpatient bill. Similarly, policy holders who have to pay a copayment per ED visit, don't have to pay said copayment if they are admitted to the hospital (they would pay their inpatient hospital copayment instead). Therefore, accounting and senior leadership at Hospital XYZ didn't calculate any revenue generated by the ED when its patients were admitted to the hospital. Notably, they also didn't calculate the % of total inpatient revenues accruing from patients that were admitted from the ED.

Finally, it is common for hospitals to set their FFS negotiation prices with private insurance companies as an additional % from what Medicare pays for each DRG. Specifically, the Chief of Strategy of Hospital XYZ explained it the following way:

"Lets say we have 100,000 patients who are insured by [X company], the number of

services we might render to those patients number in the thousands. We do not negotiate rates service by service for thousands of services, there is a fee schedule, and the fee schedule is usually based off a Medicare fee schedule and it is some percentage of Medicare plus x percentage."

Hospital XYZ Chief of Strategy

Hospital XYZ's inpatient electronic medical record (i.e. MediTech) included data fields which allowed to estimate the total revenue charge capture from Hospital XYZ's medically related inpatient services. The specific fields used were "Principal Diagnosis Description", "Principal Procedure Description", and "DRG". Using these fields we were able to leverage online DRG calculators in order to determine what Hospital XYZ received for each DRG.

Three DRG calculators together with the Medicare website, were used as follows:

- APPHC: Allows to search for a particular hospital provider, and for a particular DRG description, and automatically calculates the total amount that said hospital receives for the particular DRG (i.e. includes teaching, wage, and geographic factors) while using 2006 payments. http://apphc.com/inpatient-acute-care-drg-calculator/
- IRC: Allows to search by principal diagnosis and principal procedure to determine the specific DRG and baseline DRG payment (i.e. no adjustments included). http://cs1.claimshop.net/grouper_demo/grouper_main.aspx
- ADA: Allows to search by DRG using 2006 payment data, to determine the baseline DRG payment (i.e. no adjustments included)
- CMS: Includes the baseline payments per DRG in 2006, together with each of the adjustment indexes used for Hospital XYZ payments. https://www.cms.gov/AcuteInpatientPPS/01_overview.asp#TopOfPage

Using the above resources we calculated the reimbursement for the inpatient services rendered by Hospital XYZ to each of its 24,200 patients in 2006. Notably, one limitation of this method is that it assumes that Medicare and private insurance companies pay Hospital XYZ the same amount for the same services rendered. As previously noted, although hospitals are unable to negotiate with Medicare, they are indeed able to negotiate with private insurance companies, and will thus theoretically, charge greater prices for their services. Furthermore, different insurance companies will contract with the same hospital and pay different prices for the same procedures. Ideally, such contractually agreed values would have been used for our calculations, but understandably they are very sensitive and we thus resorted to Medicare's DRG as a proxy to enable the financial dimension of our holistic performance measurement.

iii. Patient volume distribution per inpatient specialty and inpatient service unit

The table below describes Hospital XYZ's patient volume distribution per inpatient specialty and inpatient service unit. For readability, the inpatient specialties of interest are highlighted in green. Furthermore, the top three sources of patients for each inpatient service unit are highlighted in blue. Notably one can also validate the assertions that cardiology centralizes its services in 5W, whereas neurosurgery and orthopedics centralize their services in 7C. Additionally, one can confirm that general internal medicine cares for the largest number of patients in Hospital XYZ, and that these are distributed across the inpatient service units, but in the case of 6S (also highlighted previously in our analysis) it represents as much as 55.6% of its patient volume.

Patient volume distribution per inpatient specialty and inpatient service unit

H/C Service	H_5WEST	H_6CENT	H_6EAST	H_6EASTS	H_6SOUTH	H_6WEST	H_6WESTS	H_7CENT	H_7EAST	H_7SOUTH	H_7WEST	H_5CENT	H_2EAST	H_OTHER	Grand Total
H_CARD	61.94%	0.08%	12.31%	6.67%	5.74%	6.03%	2.99%	0.03%	0.20%	4.75%	0.16%	17.00%	2.33%	11.01%	13.64%
H_COLS	0.05%	10.49%	1.39%	0.00%	2.84%	1.38%	0.00%	0.76%	21.29%	2.34%	0.72%	0.00%	10.08%	1.88%	4.26%
H_COMM	2.86%	2.11%	2.61%	0.00%	4.82%	3.90%	0.00%	1.89%	1.02%	6.23%	2.86%	1.58%	0.00%	1.21%	2.74%
H_ENDO	0.12%	0.12%	0.27%	0.00%	0.21%	0.27%	0.00%	0.03%	0.78%	0.21%	0.48%	0.00%	0.00%	0.13%	0.25%
H_GAST	0.22%	11.77%	0.96%	0.00%	2.84%	1.46%	2.99%	0.73%	1.88%	1.77%	1.03%	0.40%	0.00%	0.54%	2.29%
H_GENS	0.32%	23.86%	3.94%	0.00%	4.33%	3.28%	13.43%	8.74%	7.66%	3.68%	3.82%	1.58%	33.33%	6.17%	6.79%
H_GERI	0.47%	0.12%	0.21%	0.00%	1.06%	0.62%	0.75%	0.23%	0.41%	0.64%	0.40%	0.00%	0.00%	0.00%	0.40%
H_GIMC	29.39%	15.40%	28.62%	0.00%	55.60%	44.72%	13.43%	11.83%	8.31%	53.61%	25.30%	9.09%	2.33%	17.85%	26.18%
H_GYNC	0.10%	1.09%	0.27%	0.00%	1.56%	1.55%	0.00%	0.61%	0.90%	1.56%	26.81%	0.40%	2.33%	6.44%	3.80%
H_HEMA	0.20%	0.23%	0.21%	0.00%	0.78%	0.62%	0.00%	0.17%	0.04%	0.42%	6.32%	1.19%	0.00%	0.13%	0.94%
H_HEPA	0.07%	22.30%	0.37%	0.00%	0.64%	0.49%	0.75%	0.09%	0.20%	0.21%	0.00%	6.72%	6.20%	2.55%	2.83%
H_INFD	0.07%	0.12%	0.16%	0.00%	0.21%	0.13%	0.00%	0.12%	0.04%	0.50%	0.28%	0.40%	0.00%	0.13%	0.15%
H_IRAD	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.40%	0.03%
H_MISC	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.01%
H_NEPH	0.15%	0.19%	0.53%	0.00%	0.64%	0.31%	0.00%	0.15%	1.39%	0.57%	0.28%	0.00%	0.00%	0.13%	0.40%
H_NESG	0.12%	2.34%	0.48%	1.67%	2.34%	2.04%	26.12%	29.52%	0.29%	4.11%	0.91%	0.00%	11.63%	10.07%	5.93%
H_NEUR	0.39%	0.55%	1.07%	6.67%	2.55%	20.19%	10.45%	2.36%	0.29%	2.20%	6.92%	1.58%	0.78%	1.74%	3.74%
H_ONCO	0.02%	0.27%	0.21%	0.00%	0.78%	0.44%	0.00%	0.29%	0.08%	0.50%	6.32%	0.79%	0.00%	0.27%	0.92%
H_OPTH	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.00%	0.06%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.03%
H_ORTH	0.17%	0.58%	0.75%	0.00%	1.35%	1.15%	0.75%	37.54%	0.20%	2.97%	0.36%	0.79%	0.78%	9.80%	6.45%
H_OTOL	0.00%	0.70%	0.16%	0.00%	0.43%	0.44%	4.48%	0.35%	0.08%	0.92%	7.40%	0.00%	6.20%	3.76%	1.25%
H_PAIN	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.01%
H_PLAS	0.00%	0.55%	0.16%	0.00%	0.14%	0.31%	0.75%	1.49%	0.20%	0.64%	1.39%	0.00%	0.00%	2.15%	0.61%
H_PULM	1.58%	1.68%	2.03%	0.00%	5.96%	6.61%	21.64%	1.34%	0.82%	4.18%	5.69%	54.15%	2.33%	1.21%	3.54%
H_RHEU	0.07%	0.04%	0.11%	0.00%	0.14%	0.22%	0.00%	0.06%	0.08%	0.28%	0.12%	1.19%	0.00%	0.00%	0.12%
H_THOS	0.15%	0.08%	28.09%	23.33%	0.00%	0.22%	0.75%	0.00%	0.04%	0.14%	0.16%	0.40%	8.53%	3.76%	2.59%
H_TRAU	0.00%	0.00%	0.05%	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.01%
H_UROL	0.12%	3.55%	1.60%	0.00%	2.77%	1.46%	0.75%	1.02%	53.19%	5.95%	1.51%	0.40%	6.98%	12.21%	7.54%
H_VASM	1.16%	0.12%	1.49%	0.00%	0.92%	0.67%	0.00%	0.15%	0.04%	0.64%	0.16%	2.37%	0.00%	0.67%	0.58%
H_VASS	0.25%	1.64%	11.94%	61.67%	1.35%	1.33%	0.00%	0.35%	0.53%	0.99%	0.48%	0.00%	6.20%	5.37%	1.98%
Grand Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: The data from the above table was extracted from Hospital XYZ's inpatient EMR and represents a longitudinal sample of one year where a total of 24,200 patients were discharged.

iv. Sample Qualitative Data Excerpts

a. Clinical Support Services

Clinical Support Services External / Policy View

Interviewee	Interview quote(s)	Focused Coding
Pharmacy Director	"there has been a consolidation of surrounding hospitals, and people continue to get sick at the same rate as they always do. So volumes are way up. We joke that the good news is that we still have a job. The bad news is that the volumes are way up so we have to do more with less."	Surrounding hospital closures led to ED overcrowding
Pharmacy Director	One approach is to say that we are closed, namely closing the ER, but regulatory wise they don't want that because everybody would say that is wrong, and they keep track of how many patient you handle in the ER, so Hospital XYZ really doesn't want to do that	Regulatory requirements and oversight / regulation keeps track of ED numbers
Pharmacy Director	An ER is allowed regulatory wise, by the joint commission, to have meds more or less on a stock basis, because they know that if that guy comes in with a heart attack you don't go through the normal mechanism where the doctor places an order, the pharmacist reviews it, makes it available,... that is not how it works in the ER, where they wheel you in and they have the meds in stock, and the regulators say that is ok. But what happens when the ER deals with the patient and they place him in the room in the back where he must stay maybe for a day or two days? They are no longer ER patients, they are inpatients. Regulatory wise you are no longer allowed to get the meds as you need them to treat those patients. There are all sorts of studies out there that demonstrate that it is more dangerous to allow that to happen. If a nurse or whoever just reaches over and grabs something the odds that a mistake will happen is much higher than if it goes through the normal process, which is why the regulators say that the normal process must include the sort of interim people, which includes the pharmacist, that are able to detect potential problems of allergies, etc. You accept that that [allergies] might happen in the ER, but no one talks about it and more frequently patients are getting meds that they are allergic to, they are getting meds that they weren't supposed to, because you have to given the circumstances [emergency, no time to check]. However regulatory said that that has to stop once you are in the holding bed to go upstairs.	Regulatory requirements and oversight / regulation on admitted boarded ED patients
Pharmacy Director	So in the old days this would not happen because you would keep people in the ER and in a little while they would go upstairs. Now there is this whole section in the ER where people are kind of put on hold, so they are waiting for a bed to go upstairs, and that is challenging both for the ER and for the pharmacy. Because the mentality is different, if the patient is bleeding put a patch on him and then send him upstairs, where they will take care of him long term.	Industry history and evolution
Pharmacy Director	Inpatient pay more like per diems or DRGs. The idea there is that you are going to use the least work you can consistent with getting the person out of the hospital with a certain level of care. But you don't want to have an expensive drug used when a cheaper drug would suffice. That is basically the rules. They are cost based. So if	Payer system influence/pressure

	you spent 15 million on drugs, then that is 15 million that you just spent. So if I could get that cost down to 5 million and go to administration, they would see that as a 10 million in savings. [...] From the outpatient side we would still like to do it because a lot of times it constitutes better care but the financial product is simply not there.	
Pharmacy Director	Inpatient hospitals have been on the edge of unprofitable for some time, since the mid 80s, and you have to be pretty vicious to survive.	Industry history and evolution

Clinical Support Services Strategy View

Interviewee	Interview quote(s)	Focused Coding
Pharmacy Director	"So now why do we have all these patients [...]. One reason is that [Hospital XYZ] went out and aggressively pursued new specialties like liver transplant."	Enterprise transformation strategic scope/ New specialties led to ED patient overcrowding

Clinical Support Services Service View

Interviewee	Interview quote(s)	Focused Coding
Laboratory Director	We also have outside facilities that use our lab.	Extended enterprise management
Laboratory Director	The ED and ORs have their own system to see the results... but they all still have to order through the arcaic LCMC system. I don't know why, we call it the LCMC.	Service architecture management / flow information transparency and timeliness
Laboratory Director	Often there isn't an order for a given specimen and we have to call them [the physicians] and ask them what they want.	Service architecture awareness / shared understanding of downstream & upstream effects
Pharmacy Director	This is very inefficient. The nurses that are in that holding area are more trained [expensive]. The other problem is that patients that go through surgery and wake up they don't expect to wake up in the recovery room. But with the current situation [overload] you may need to stay in the recovery room for a day or two, waiting for something to open up upstairs, so that you can go there. That is extremely inefficient because the recovery nurse is a very expensive nurse, it is very expensive care, and you cannot simply think that "well they get paid for that anyway" because they are a cost item geared for other things. And we absorb that cost because the patient needs to stay in the recovery room because we don't have room for them elsewhere.	Service architecture management / inefficient use of staff Service sustainability / Patient experience negatively impacted by ED overcrowding
Pharmacy Director	I would say there is generally a disjointed view of this organization. It is so big that the left hand does not know what the right hand is doing. Communication is becoming a bigger issue than what I am used to. It isn't always an issue but... It is hard to get anything out to everybody. It is hard for everybody to understand where we are going with this or that.	Service architecture awareness/ shared understanding downstream & upstream effects
Pharmacy Director	What has happened with the increased workload hitting the hospital and we have all been squandering to figure out how it works when it is that busy. And one of those things is within the ED. It used to be that you come in and they would decide that you	Service sustainability / Patient experience negatively impacted by ED overcrowding

	need to be admitted or that you need to go home. In the old days when they decided you needed to be admitted they would say you need specifically an IC (intensive care) bed, or that you need a telemetry bed, or that you need a regular bed, or whatever, and then they would send you there, and this would happen within an hour or two. Now what has happened is that there is a third group of patients where we are deeply clogged up upstairs and we wont have the kind of bed that this guy needs.	
Pharmacy Director	Here we have a sort of outpatient world attached to the organization, and that is a bit disconcerting to people who have been in the business for a long time. Most places aren't that way. Most places a hospital is a hospital. You know, an inpatient hospital.	Service architecture awareness / outpatient services not fully integrated with inpatient
Pharmacy Director	there is a tendency for nurses to go and steal meds from the other machines	Service architecture awareness/ shared understanding downstream & upstream effects Service sustainability / Patient experience potentially negatively impacted due to localized process optimization behavior

Clinical Support Services Process View

Interviewee	Interview quote(s)	Focused Coding
Laboratory Director	The laboratory has priorities. The OR, the units, the ED, those specimens are handled as a priority so that we can turn around results as quickly as possible. That said the ED, bought a new system called the T-System so that they can see their results appear on their board when they are ready. That is one of the areas that is innefficient as we don't know when an insular area has checked the test [on the arcaic system]	Degree of process standardization and transparency
Laboratory Director	Often there isn't an order for a given specimen and we have to call them [the physicians] and ask them what they want.	Service unit process optimization behavior / stakeholders ignore standards to locally optimize their system
Pharmacy Director	However regulatory said that that has to stop once you are in the holding bed to go upstairs. Therefore we had to setup a process to deal with this situation. [...]In the ER we have Pyxis machines. The part of the ER where it is like an emergency, those are served with candy machines because they need to give the meds right away, without need of sending an order to the pharmacy, so they can list up all the meds that are available in the candy machine and get what they need. But the regulators didn't allow us to that in the other section [holding area] because in reality patients in there are no longer in an emergency status and rather in an hospital setting.	Enterprise process improvement and planning scope / evidence of narrow bolt-ons Degree of core process complexity
Pharmacy Director	there is a tendency for nurses to go and steal meds from the other machines	Service unit process optimization behavior / stakeholders ignore standards to locally

		optimize their system

Clinical Support Services Organization View

Interviewee	Interview quote(s)	Focused Coding
Pharmacy Director	Here we have a sort of outpatient world attached to the organization, and that is a bit disconcerting to people who have been in the business for a long time. Most places aren't that way. Most places a hospital is a hospital. You know, an inpatient hospital.	Enterprise cultural harmony / clinical staff unhappy with Hospital XYZ's commitment to surrounding community
Pharmacy Director	In the ER we have Pyxis machines. The part of the ER where it is like an emergency, those are served with candy machines because they need to give the meds right away, without need of sending an order to the pharmacy, so they can list up all the meds that are available in the candy machine and get what they need. But the regulators didn't allow us to that in the other section [holding area] because in reality patients in there are no longer in an emergency status and rather in an hospital setting.	Organizational climate / job satisfaction (relates to ED nurses frustrated with caring for boarded patients)
Pharmacy Director	So Hospital XYZ clinic started as a Hospital XYZ clinic... their heart and soul was an organization that functioned as a clinic, and an outpatient center. A lot of the old administrative people came from downtown where they started the clinic. In essence they were like a big private practice of docs, so that whenever someone needed to send a patient to a hospital they would send him to [ABC] Hospital or whatever and that place would function as the hospital. So you can kind of visualize this place being a kind of doctors practice in those days. So Hospital XYZ in fact did the opposite of a lot of people. So in 1980, they said that we are losing control of our patients and instead of sending them to Brigham, we should build our own hospital. I can tell the difference. So Hospital XYZ sees itself as a big doctors partners that went and bought a hospital, so there is a different mindset from a hospital that adds an outpatient function. We are very much a doctor's hospital here. We are very much owned and operated by physicians. Most hospitals are not owned and operated by physicians. Most hospitals are operated by another party and doctors have some control of what is going on, but it is largely the administrative side that handles a lot of the procedures. Here [Hospital XYZ] physicians do a lot of things. They are on the board of governors. This is good because physicians keep a focus on patient care issues, which sometimes administrators say this is how we make money, and doctors are interested in that too, but they do not want to give up the patient care part of it.	Enterprise History / enterprise run by physicians who built a hospital, as opposed to a hospital who purchased a group practice

Clinical Support Services Information View

Interviewee	Interview quote(s)	Focused Coding
Laboratory Director	The ED and ORs have their own system to see the results... but they all still have to order through the arcaic LCMC system. I don't know why, we call it the LCMC.	Information systems integration
Laboratory Director	The laboratory has priorities. The OR, the units, the ED, those specimens are handled as a priority so that we can turn around results as quickly as possible. That said the ED, bought a new system called the T-System so that they can see their results appear on their board when they are ready. That is one of the areas that is	Information systems integration Information timeliness

	innefficient as we don't know when an insular area has checked the test [on the arcaic system]	IT user friendliness
Laboratory Director	The lab has its own computer system and we are interfaced with the main hospital computer system. The main hospital [lab] computer system is arcaic. It is homegrown and its been here forever. If I need to order five tests on you, I have to go in five times to choose the test, not you [as] I have chosen you once, [but] I have to go in five times and then five times, it has to be already accepted by the physician who ordered it, [and] I have to say the priority, I have to say if there is anything else to do, ... in the laboratory we order five tests all at once, they put them all together in one session number.	Information systems integration / lab has state-of-the-art system while hospital services have homegrown solution IT user friendliness
Laboratory Director	However thousands of results are displayed and physicians have to remember which code they have already read and which one is for their particular patient.	IT user friendliness
Laboratory Director	There are some [specimens] that are considered to be critical, that we need to alert somebody immediately. So the laboratory does a phone call, or lots of phone calls to students, physicians, etc maybe their case is where they expected a result because they know the patient who is in a crisis. Other times they have no idea about this patient having critical tests being done on them. Efficiency wise it is sometimes hard to find the right person because the patients sometimes go from this floor, now they are in the OR, or went down to radiology, they are all over the place. Sometimes it is hard to find where the patient is so that we can send the result to them. Each floor will say "we sent him there" then you call here and they say "we sent them there".	Data reliability Information timeliness Workflow information system
Laboratory Director	In our core lab there are a lot of pneumatic tubes and these pneumatic tubes are connected to areas like the emergency room, the OR suites, actually a lot of hospital areas, and when they collect specimens they send them right down the pneumatic tube. We get them and supposedly most of them should be with the order in the tube already so that we know what they went from us. But every once in a while there are some that come without orders, or with difficult hand writting, etc. It is an arcaic lab system where it is more laborious to insert the order in the computer than it is to write it by hand.	Data reliability Prevalence of paper information systems IT user friendliness
Pharmacy Director	It was interesting because the other day there were 4 doctors trying to understand another doctor's writing. This is acceptable in a mechanic garage setting where he is full of grease and stuff so he cannot use a computer. But in our world one of these drugs could potentially kill you, therefore we need to move away from the current world [towards more technology solutions] but it is difficult to do that. It is frustrating because we don't even barcode our drugs.	Prevalence of paper information systems Data reliability (visualization)

b. Administrative Support Services

Administrative Support Services External View

Interviewee	Interview quote(s)	Focused Coding
Associate Chief Nurse Med/Surg	The nurses focus a lot on patient falls because you know it is a national patient safety goal. But that information does not necessarily get back to the nursing leadership.	Regulatory requirements and oversight: national goals affect what

		nurses care about
Process Improvement Project Manager	The problem here is that I get dictated what I need to do. There is a lot of requirements. Books and books of requirements. Really a lot. Requirements can be separated into two categories. The first category is the "do good organizations". There is probably 5 to 7 of them, they mean very well, like Leapfrog, you don't have to do it, you raise your hand and you'll do it. [the other category] Then you have to do what the Joint Commission tells you. The department of public health you have to do what they say. And CMS, government stuff, you have to do what they say.	Regulatory requirements and oversight Payer system influence/pressure
Quality and Safety Director	Personally I am not going to work any less hard because I am expecting a bonus for something. However, pay for performance does help the organization focus on in terms of what is important. So I may not work any harder because I know we need to improve these quality scores on this five items by 50%. I am going to do that anyway. But what it does force is the organization [chuckle] to declare what are we going to work on improving next year. It helps focus.	Payer system influence/pressure
Quality and Safety Director	The community would never accept having a tertiary medical center in this area without an ED. They would feel that we weren't meeting the needs of the community. If [Hospital XYZ] had its way it wouldn't have an ED. It would primarily be a surgical facility and a specialty hospital, in the sense that not every specialty here is a surgical specialty, so there is still a commitment to and a focus on medical specialty. But even among the specialties my opinion is that the surgeon in terms of stature is higher than the other medical specialty. The CEO is a surgeon, the prior CEO is a surgeon, ... generally the operative services generate more revenue than the medical services.	Surrounding community oversight
Planning Director	All the care that we are supposed to provide and we measure are defined in terms of the core measures. Strict definitions, national definitions, about what you look for, what has to be documented, and what you are supposed to do. Pneumonia needs antibiotics 4 hours, a heart attack needs an aspirin, etc.	Payer system influence/pressure
Quality and Safety Director	Some health plans are beginning to include quality measures into the contracts. I don't do contracts [chuckle] I just worry about performance, so I don't know how much is tied to each measure. For example improving our pneumonia vaccine rate we had some dollars tied to that.	Payer system influence/pressure
Quality and Safety Director	Now they have added these three measures and now we have to focus on this, versus being run by our strategy and an understanding of our processes. Some of the chaos is that you are trying to run your organization well, but you are kind of in this reactive mode as things are changing externally. These CMS core measures [time to aspirin, etc] we are paid right now because we capture these measures and we report them publically. So as long as we capture it and report it to CMS we get paid. Right now our incentive to do well on CMS measures is only public perception.	Payer system influence/pressure
Process Improvement Project Manager	When we find holes using Leapfrog data it is not clear that we jump on those and do something. Leapfrog is pretty wonderful. It could be that we are just overwhelmed with all these requirements. So when a do good organization asks you to do these [additional requirements] you say "unless it is not required,	Payer system influence/pressure

	don't ask me right now". [...] 90% of the stuff on our plate is a requirement. Out of the 90%, 70% is hand washing, what you have to do is very clear, maybe 20% is that senior management has to do things to mitigate patient flow issues, and then [the remaining] 10% is something that we put on there that no one is requiring us to do.	
Process Improvement Project Manager	Then you have to do what the Joint Commission tells you. The department of public health you have to do what they say. And CMS, government stuff, you have to do what they say.	Regulatory requirements and oversight
Process Improvement Project Manager	30% of the delays are because family members don't come around on time to pick up patients.	Patient behavior/impact
Quality and Safety Director	Between the pending or the current shortages of personnel, the baby boomer generation just hiting higher healthcare needs, and such, I don't know how we are going to be able to handle this. I think it is going to get much more chaotic before it potentially gets any better.	Industry history and evolution

Administrative Support Services Strategy View

Interviewee	Interview quote(s)	Focused Coding
Associate Chief Nurse Perioperative Services	I am surgical services, the revenue generator for the hospital. I know you have read all the literature where they say that the elective cases should be cancelled so that we can keep the ER moving. That is not the vision. I really think that Dr. [CEO] or Dr. [COO] would come up here saying for us not to cancel elective cases to keep the ER running. If we cancel elective cases we've now lost revenue. So we have a conflict of interests.	Strategic alignment / conflict
Associate Chief Nurse Perioperative Services	Every day we run into issues with flow in the ER and with flow in surgical services. You know you can guess why because patients come into the ED, we have now opened 4 more ORs, and probably consistingly between 11am and 2pm everyday we kind of have this freeze situation where the ED has patients that go up, the main recovery room that is our PACU has anywhere between 6 to 8 patients every night that are down there now who are waiting to go someplace, whether they are waiting to go to an ICU, whether they are going to an inpatient area.	Enterprise transformation strategic scope: only added ORs
Associate Chief Nurse Perioperative Services	We just increased the number of our operating rooms by 4 and we filled them. What we didn't do at the same time is that we didn't increase our holding area so that when patients came in the morning we would have more space to hold them before they went into the OR. Also, we have a PACU that is about to open and it should have been open at the same time as the ORs.	Enterprise transformation strategic scope: only added ORs, didn't adopt phased approach
Associate Chief Nurse Perioperative Services	You have compitition between the ED and the OR for beds. [Nursing Manager X's] job is really to figure out who needs the priority at that time.	Strategic alignment / conflict
Associate Chief Nurse Med/Surg	We run a very interesting report from Pyxis. We have the Pyxis OR management system. So I can give you any statistic	Information systems strategy: each silo

	that you wanted, and one of the statistics that we decided to look at was how long do patients wait in the OR. Sometimes we have as many as 8% of patients waiting in the OR to go to the ambulatory PACU. If you correlate that back to the ED I bet you'll see a sharing of beds [the ED was getting the beds and holding up the OR flow]. "Okay the ED have 15 to 18 patients now, so we have to let the OR hold inside for a while because the ED is in more of a crisis than the OR". But when you keep patients in there [OR] for 3 hours all you have is an anethesiologist watching your airway, you don't have nurse watching everything else. So we struggle with that.	runs its own state of the art IT system; contributes to enterprise dysfunctionality
Quality and Safety Director	Personally I am not going to work any less hard because I am expecting a bonus for something. However, pay for performance does help the organization focus on in terms of what is important. So I may not work any harder because I know we need to improve these quality scores on this five items by 50%. I am going to do that anyway. But what it does force is the organization [chuckle] to declare what are we going to work on improving next year. It helps focus.	Strategy dilution Enterprise strategy
Quality and Safety Director	That is the part that you may be cautioned about... because I think that the ED in part understands this... It is with some reluctance that there is investment made in that area, because it is not the engine.	Enterprise transformation strategic scope
Process Improvement Project Manager	I think that someplace in [Hospital XYZ] there is a list of a lot of committees.	Enterprise transformation strategic scope
Process Improvement Project Manager	One of the companies that I worked out... everybody has a list of a million things that they got to do, but what they did every quarter they came out with a list and said "these are the seven things that are priority for this quarter". So I would put that up in my wall. So when I knocked in your door you knew that was 1 to 7. You get more collaboration because you know what the 7 are. Right now [at Hospital XYZ] there is 100 of them! There is so much stuff going on! So I knock on someone's door and I just have to knock louder, be pushy sometimes, and try to get something up on his radar screen. I have asked [Chief of Strategy] many times to tell us what the big seven are.	Strategy dilution
Planning Director	Decision support data is finalized billing data. Because of the way healthcare is managed and billed there is a tremendous amount of detail that is captured in each transction. We use 250 fields from Meditech [...] All the measures that people want to do it nationally are based on something that everybody does. And in order to do that you need to abstract data from the chart, and use the same coding for the same procedures, everybody does that, it is called administrative data. All the national measures are based of administrative data. [...] All the care that we are supposed to provide and we measure are defined in terms of the core measures. Strict definitions,	Enterprise strategy

	national definitions, about what you look for, what has to be documented, and what you are supposed to do. Pneumonia needs antibiotics 4 hours, a heart attack needs an aspirin, etc.	
Planning Director	asset is the OR, and I can prove that by shutting it down for a day.	Enterprise strategy

Administrative Support Services Service View

Interviewee	Interview quote(s)	Focused Coding
Associate Chief Nurse Perioperative Services	"Okay the ED have 15 to 18 patients now, so we have to let the OR hold inside for a while because the ED is in more of a crisis than the OR". But when you keep patients in there [OR] for 3 hours all you have is an anethesiologist watching your airway, you don't have a nurse watching everything else. So we struggle with that.	Service sustainability (patient experience)
Associate Chief Nurse Perioperative Services	You have competition between the ED and the OR for beds. [Nursing Manager X's] job is really to figure out who needs the priority at that time.	Service architecture management: competition amongst shared resources
Associate Chief Nurse Perioperative Services	We just increased the number of our operating rooms by 4 and we filled them. What we didn't do at the same time is that we didn't increase our holding area so that when patients came in the morning we would have more space to hold them before they went into the OR. Also, we have a PACU that is about to open and it should have been open at the same time as the ORs.	Service architecture awareness: transformation efforts lack understanding of service architecture
Associate Chief Nurse Med/Surg	Often times you find that you don't have the right people at the right table. Some think that pharmacy and nursing should be working together as they don't have as good a collaborative relationship and don't see their work dependency.	Service architecture awareness/appreciation: architecture adversely affected by lack of cultural harmony
Process Improvement Project Manager	I need a patient flow steering committee. We had one 5 months ago but it got disbanded because it wasn't working as well as it could and because[the Chief of Strategy] got really busy with other stuff. I think we need more of the middle managers on this committee rather than what we had before [too high level].	Service architecture management *Cross departmental management boards*
Process Improvement Project Manager	30% of the delays are because family members don't come around on time to pick up patients.	Extended enterprise management

Administrative Support Services Process View

Interviewee	Interview quote(s)	Focused Coding
Associate Chief Nurse Perioperative Services	"Okay the ED have 15 to 18 patients now, so we have to let the OR hold inside for a while because the ED is in more of a crisis than the OR".	Prevalence of undesireable standard processes (e.g. fire fighting)
Associate Chief Nurse Perioperative Services	You have competition between the ED and the OR for beds. [Nursing Manager X's] job is really to figure out who needs the priority at that time.	Prevalence of undesireable standard processes (e.g. fire fighting)
Associate Chief Nurse Perioperative Services	We run a very interesting report from Pyxis. We have the Pyxis OR management system. So I can give you any statistic that you wanted, and one of the statistics that we decided to look at was how long do patients wait in the OR. Sometimes we have as	Process enterprise measurement capability: unable to cross reference info

	many as 8% of patients waiting in the OR to go to the ambulatory PACU. If you correlate that back to the ED I bet you'll see a sharing of beds [the ED was getting the beds and holding up the OR flow]	from OR and ED systems
Associate Chief Nurse Perioperative Services	Every day we run into issues with flow in the ER and with flow in surgical services. You know you can guess why because patients come into the ED, we have now opened 4 more ORs, and probably consistingly between 11am and 2pm everyday we kind of have this freeze situation where the ED has patients that go up, the main recovery room that is our PACU has anywhere between 6 to 8 patients every night that are down there now who are waiting to go someplace, whether they are waiting to go to an ICU, whether they are going to an inpatient area. Around that time in the morning most of us are getting paged, you know I'm getting paged from the OR "Debbie we are starting to hold patients in the OR"	Prevalence of undesireable standard processes (e.g. fire fighting)
Associate Chief Nurse Perioperative Services	Usually around 9.30 today we would gather around a table and we sit as nurses, we don't really have physicians sitting with us at that time, and we decide who is going to get them [the beds] now. Hour by hour we are saying who is going to get what. At that time an email usually goes out saying to discharge all your patients and we just hope that we can keep the ED and the OR going. The physicians aren't involved at all unless I get the impression that we have to cancel a [elective] case.	Prevalence of undesireable standard processes (e.g. fire fighting)
Associate Chief Nurse Perioperative Services	I really think that Dr. [CEO] or Dr. [COO] would come up here saying for us not to cancel elective cases to keep the ER running. If we cancel elective cases we've now lost revenue. So we have a conflict of interests.	Leadership Support of Operations: CEO/COO reinforcing procedure focused strategy
Associate Chief Nurse Perioperative Services	Dr. [X] on the other side is the Chief of Surgery is going to day "Debbie we are not cancelling anything. You know what we can sit down and relook at all this but it is a huge job to take a [scheduling] block based system and redo it all" [...] We actually had no block scheduling up until 2 years ago which made it worse for the nursing staffing because we never knew who was working when.	Degree of process complexity and flexibility
Associate Chief Nurse Med/Surg	Each nursing area has its own process for different types of orders and that contributes to a silo effect where a nurse only knows how to do things in a given area even when those things are also done elsewhere [the information content of each order is different depending on the nursing area where it originates] [...] I see a lot of different silos. Nurses from different departments create a lot of standard norms, and these don't get rooted back to any interdisciplinary committee.	Degree of process standardization Degree of process complexity and flexibility: flexibility hindered by lack of standards Modes of coordination / cross department board: unable to prevent silo effect that produce local standards
Associate Chief Nurse Med/Surg	The nurses focus a lot on patient falls because you know it is a national patient safety goal. But that information does not necessarily get back to the nursing leadership.	Process enterprise measurement capability: metrics

		not captured
Planning Director	We are unable to pull data from the OR as they are using their own excel sheet systems and we have not been able to integrate that data.	Service unit process optimization behavior Process enterprise measurement capability
Planning Director	This is a huge system that runs once a month and takes almost 4 days to get this data out. It isn't operational data	Process enterprise measurement capability
Planning Director	A coke and chocolate cookies can get you the data from the OR. I stole a file from them like that otherwise I couldn't see what data they had. The number one asset that [Hospital XYZ] has is its people. The number two asset is the OR, and I can prove that by shutting it down for a day.	Process enterprise measurement capability
Process Improvement Project Manager	The T system data isn't reliable because different nurses write their notes in different ways. Some write the notes into the T system immediately after the physician sees the patient. Others write the notes in a batch process and assign the same time of observation to every patient. It is very difficult to figure out what the precise timings are in each stage of the process.	Degree of process standardization *Lack of standard contributes to data reliability issues*
Planning Director	JO: What is planned under teaching and research [as far as metrics?] That is a good question! I hope to have an answer soon...	Process enterprise measurement capability
Planning Director	Decision support for us is that we want to keep a subset of our data and being able to bucket it and categorize it in very different ways. We want to look at patients that had Harvard Pilgrim insurance and had open heart surgery. Who did it? How long were they here? What were the charges?	Holistic performance measurement *Content is holistic but process isn't*
Planning Director	Decision support data is finalized billing data. Because of the way healthcare is managed and billed there is a tremendous amount of detail that is captured in each transction. We use 250 fields from Meditech	Holistic performance measurement *Content is financial based*
Quality and Safety Director	Some health plans are beginning to include quality measures into the contracts. I don't do contracts [chuckle] I just worry about performance, so I don't know how much is tied to each measure. For example improving our pneumonia vaccine rate we had some dollars tied to that.	Holistic performance measurement
Quality and Safety Director	I have no idea what the financial contribution of the ED is. [...] Physicians are here to do the high tech really cutting edge stuff. And surgeries are really what generates revenue here and that is kind of the sexy work to do.	Holistic performance measurement Process enterprise measurement capability Enterprise process improvement and planning scope
Quality and Safety Director	We haven't spent much time at our organization thinking about what our key processes are. We have a whole list of processes but we don't characterize any of them as key.	Enterprise process improvement and planning scope
Quality and	Now they have added these three measures and now we have to	Enterprise process

Safety Director	focus on this, versus being run by our strategy and an understanding of our processes. Some of the chaos is that you are trying to run your organization well, but you are kind of in this reactive mode as things are changing externally. These CMS core measures [time to aspirin, etc] we are paid right now because we capture these measures and we report them publically. So as long as we capture it and report it to CMS we get paid. Right now our incentive to do well on CMS measures is only public perception.	improvement and planning scope
Process Improvement Project Manager	[The Quality&Safety Director] just owns the quality and safety ones. She has her own list of stuff. [The Planning Director] has a lot of electronic medical records, and another nice page [of things to do]. IT has there own page of big stuff to do. Theoretically this should come from strategic planning.	Enterprise process improvement and planning scope *Strategy absent* Holistic performance measurement
Process Improvement Project Manager	We had a few efforts like the discharge appointment process to reduce discharge time of day.	Enterprise process improvement and planning scope *Narrow*
Process Improvement Project Manager	What is going to happen with this new process engineer is that they are going to primarily stick this person in the operating services in the operating room. 80% of that person's time will be just doing the OR stuff. The OR they say is where the money happens. The surgery is a lot more profitable than the medical.	Enterprise process improvement and planning scope *Narrow*
Process Improvement Project Manager	90% of the stuff on our plate is a requirement. Out of the 90%, 70% is hand washing, what you have to do is very clear, maybe 20% is that senior management has to do things to mitigate patient flow issues, and then [the remaining] 10% is something that we put on there that no one is requiring us to do.	Enterprise process improvement and planning scope
Process Improvement Project Manager	One of the companies that I worked out... everybody has a list of a million things that they got to do, but what they did every quarter they came out with a list and said "these are the seven things that are priority for this quarter". So I would put that up in my wall. So when I knocked in your door you knew that was 1 to 7. You get more collaboration because you know what the 7 are. Right now [at Hospital XYZ] there is 100 of them! There is so much stuff going on! So I knock on someone's door and I just have to knock louder, be pushy sometimes, and try to get something up on his radar screen. I have asked [Chief of Strategy] many times to tell us what the big seven are.	Enterprise process improvement and planning scope *Strategy dilution*

Administrative Support Services Organization View

Interviewee	**Interview quote(s)**	**Focused Coding**
Associate Chief Nurse Perioperative Services	I am surgical services, the revenue generator for the hospital. I know you have read all the literature where they say that the elective cases should be cancelled so that we can keep the ER moving. That is not the vision. I really think that Dr. [CEO] or Dr. [COO] would come up here saying for us not to cancel elective cases to keep the ER running. If we cancel elective cases we've now lost revenue. So we have a conflict of interests.	Local organizational climate and subculture

Associate Chief Nurse Perioperative Services	You have competition between the ED and the OR for beds. [Nursing Manager X's] job is really to figure out who needs the priority at that time.	Enterprise cultural harmony: adverse effect of lack of strategic alignment / conflict
Associate Chief Nurse Perioperative Services	Dr. [X] of course would say "You know just cancel those elective cases Debbie", and you know he would because his important piece is the ED. Dr. [Y] on the other side is the Chief of Surgery is going to say "Debbie we are not cancelling anything. You know what we can sit down and relook at all this but it is a huge job to take a [scheduling] block based system and redo it all". So you have competing high levels because they have vested interests in their own division.	Enterprise cultural harmony: adverse effect of lack of strategic alignment / conflict Local organizational climate and subculture
Associate Chief Nurse Perioperative Services	Usually around 9.30 today we would gather around a table and we sit as nurses, we don't really have physicians sitting with us at that time, and we decide who is going to get them [the beds] now. Hour by hour we are saying who is going to get what. At that time an email usually goes out saying to discharge all your patients and we just hope that we can keep the ED and the OR going. The physicians aren't involved at all unless I get the impression that we have to cancel a [elective] case.	Local organizational climate and subculture: stressful (we just hope to keep things going)
Associate Chief Nurse Perioperative Services	Usually around 9.30 today we would gather around a table and we sit as nurses, we don't really have physicians sitting with us at that time, and we decide who is going to get them [the beds] now.	Modes of coordination / Cross departmental management boards
Associate Chief Nurse Perioperative Services	Usually around 9.30 today we would gather around a table and we sit as nurses, we don't really have physicians sitting with us at that time, and we decide who is going to get them [the beds] now.	Enterprise cultural harmony: nurses vs physicians
Associate Chief Nurse Perioperative Services	What happened in the main recovery room... in the last 2 months I have lost 7 nurses for working there. When you go to work in the recovery room you want the patients to recover. Like in the emergency room, you want to the patients to come into the ED, to be seen, and to home or someplace. So you have nurses that choose their specific areas [for a given type of patient population]. A nurse did not choose that area because she thought she could take care of 18 patients overnight. She thought maybe 2 might, but 18 is too much. So that is huge for us to train now 7 more nurses. To really train a good PACU nurses we can have them trained in 4 to 5 months.	Local organizational climate: nurses quitting because of role disconnect
Chief Nurse Perioperative Services	Dr. [X ED Director] and Dr. [Y Surgery Director] report separately to the CEO. I don't think that the CEO tells them where to go.	Leadership acceptance by internal stakeholders
Associate Chief Nurse Med/Surg	Each nursing area has its own process for different types of orders and that contributes to a silo effect where a nurse only knows how to do things in a given area even when those things are also done elsewhere [the information content of each order is different depending on the nursing area where it originates]	Local organizational climate and subculture: the lack of standards across the enterprise reinforces silo culture
Associate Chief Nurse Med/Surg	Often times you find that you don't have the right people at the right table. Some think that pharmacy and nursing should be working together as they don't have as good a collaborative relationship and don't see their work dependency.	Prevalence of cultural silos

Planning Director	When I first came here 2 years ago that [the OR] was a black box, you didn't enter, we are not giving you any data, what the hell do you want the data for. That was the kind of response that I got when I came here 2.5 years ago. In the last six months we have a new chief of surgery and her response is "what do you mean I can't have that data? what do you mean I can't have access to that data?"	Prevalence of cultural silos: local leadership dependant
Planning Director	Leadership support for data transparency is very variable across specialties. Department like orthopedics, doctor [X] has been into data for a long time. I would say if there is a grand daddy of data collection at [Hospital XYZ] it is probably doctor [X]. In an access database. It is "their" access database, because that is the right adjective, and published papers with that data. They look at what we are trying to do skeptically.	Prevalence of cultural silos: local leadership dependant
Planning Director	A coke and chocolate cookies can get you the data from the OR. I stole a file from them like that otherwise I couldn't see what data they had. The number one asset that [Hospital XYZ] has is its people. The number two asset is the OR, and I can prove that by shutting it down for a day.	Prevalence of cultural silos
Process Improvement Project Manager	The philosophy at [Hospital XYZ] is that for each individual application we want to get the best software and then afterwards we'll figure out how to tie it all together.	Prevalence of cultural silos *Drive IT fragmentation*
Planning Director	My job is to provide clinical data for people so that they can take care of patients better and that is the only reason I come to work in the morning.	Individual incentives
Planning Director	And then you have doctors in the middle who say "listen I am really good at what I do, and I am going to do what I do, and don't bother me with other stuff". [...] Nationally physicians have a lot of political clout, they have a lot of economic clout, and they still have the pen or the keyboard as to what resources get used.	Prevalence of cultural silos
Quality and Safety Director	Personally I am not going to work any less hard because I am expecting a bonus for something. However, pay for performance does help the organization focus on in terms of what is important. So I may not work any harder because I know we need to improve these quality scores on this five items by 50%. I am going to do that anyway. But what it does force is the organization [chuckle] to declare what are we going to work on improving next year. It helps focus.	Individual incentives
Quality and Safety Director	Physicians are here to do the high tech really cutting edge stuff. And surgeries are really what generates revenue here and that is kind of the sexy work to do. [...] even among the specialties my opinion is that the surgeon in terms of stature is higher than the other medical specialty. The CEO is a surgeon, the prior CEO is a surgeon, ... [...] generally the operative services generate more revenue than the medical services.	Individual incentives Enterprise history and culture *Focus on procedures*
Quality and Safety Director	The community would never accept having a tertiary medical center in this area without an ED. They would feel that we weren't meeting the needs of the community. If [Hospital XYZ] had its	Enterprise history and culture

	way it wouldn't have an ED. It would primarily be a surgical facility and a specialty hospital, in the sense that not every specialty here is a surgical specialty, so there is still a commitment to and a focus on medical specialty. But even among the specialties my opinion is that the surgeon in terms of stature is higher than the other medical specialty. The CEO is a surgeon, the prior CEO is a surgeon, ... generally the operative services generate more revenue than the medical services.	
Quality and Safety Director	That is the part that you may be cautioned about... because I think that the ED in part understands this... It is with some reluctance that there is investment made in that area, because it is not the engine.	Enterprise history and culture Enterprise cultural harmony
Improvement Project Manager	I need a patient flow steering committee. We had one 5 months ago but it got disbanded because it wasn't working as well as it could and because[the Chief of Strategy] got really busy with other stuff. I think we need more of the middle managers on this committee rather than what we had before [too high level].	Cross departmental management boards
Process Improvement Project Manager	What is going to happen with this new process engineer is that they are going to primarily stick this person in the operating services in the operating room. 80% of that person's time will be just doing the OR stuff. The OR they say is where the money happens. The surgery is a lot more profitable than the medical.	Enterprise history and culture
Process Improvement Project Manager	I need a patient flow steering committee. We had one 5 months ago but it got disbanded because it wasn't working as well as it could and because[the Chief of Strategy] got really busy with other stuff. I think we need more of the middle managers on this committee rather than what we had before [too high level].	Leadership acceptance by internal stakeholders

Administrative Support Services Knowledge View

Interviewee	Interview quote(s)	Focused Coding
Associate Chief Nurse Perioperative Services	We run a very interesting report from Pyxis. We have the Pyxis OR management system. So I can give you any statistic that you wanted, and one of the statistics that we decided to look at was how long do patients wait in the OR. Sometimes we have as many as 8% of patients waiting in the OR to go to the ambulatory PACU. If you correlate that back to the ED I bet you'll see a sharing of beds [the ED was getting the beds and holding up the OR flow]	Organizational learning capability: unable to improve at enterprise level due to fragmented systems
Associate Chief Nurse Perioperative Services	What happened in the main recovery room... in the last 2 months I have lost 7 nurses for working there. When you go to work in the recovery room you want the patients to recover. Like in the emergency room, you want to the patients to come into the ED, to be seen, and to home or someplace. So you have nurses that choose their specific areas [for a given type of patient population]. An ED nurse did not choose that area because she thought she could take care of 18 patients overnight. She thought maybe 2 might, but 18 is too much. So that is huge for us to train now 7 more nurses. To really train a good PACU nurses we can have them trained in 4 to 5 months.	Knowledge transfer requirements
Associate Chief Nurse Med/Surg	You say it 5 times, and you probably need to say it 5 times more so that it gets implemented and part of the culture.	Knowledge transfer requirements
Associate	There are processes for nurses to capture information in form	Organizational

Chief Nurse Med/Surg	format. However that form gets sent somewhere and sometimes you want to be able to revisit the form and you don't have an easy way to access the form.	learning capability: unable to retrieve information
Planning Director	Leadership support for data transparency is very variable across specialties. Department like orthopedics, doctor [X] has been into data for a long time. I would say if there is a grand daddy of data collection at [Hospital XYZ] it is probably doctor [X]. In an access database. It is "their" access database, because that is the right adjective, and published papers with that data. They look at what we are trying to do skeptically.	Knowledge access priveleges/restrictions
Planning Director	A coke and chocolate cookies can get you the data from the OR. I stole a file from them like that otherwise I couldn't see what data they had. The number one asset that [Hospital XYZ] has is its people. The number two asset is the OR, and I can prove that by shutting it down for a day.	Knowledge access priveleges/restrictions

Administrative Support Services Information View

Interviewee	Interview quote(s)	Focused Coding
Associate Chief Nurse Perioperative Services	We run a very interesting report from Pyxis. We have the Pyxis OR management system. So I can give you any statistic that you wanted, and one of the statistics that we decided to look at was how long do patients wait in the OR. Sometimes we have as many as 8% of patients waiting in the OR to go to the ambulatory PACU. If you correlate that back to the ED I bet you'll see a sharing of beds [the ED was getting the beds and holding up the OR flow]	Information systems integrationÇ isolated systems prevent cross referencing workflow info Workflow information system
Associate Chief Nurse Perioperative Services	Usually around 9.30 today we would gather around a table and we sit as nurses, we don't really have physicians sitting with us at that time, and we decide who is going to get them [the beds] now. Hour by hour we are saying who is going to get what. At that time an email usually goes out saying to discharge all your patients and we just hope that we can keep the ED and the OR going. The physicians aren't involved at all unless I get the impression that we have to cancel a [elective] case.	Information systems integration: hourly system updates sent over email
Associate Chief Nurse Med/Surg	There are processes for nurses to capture information in form format. However that form gets sent somewhere and sometimes you want to be able to revisit the form and you don't have an easy way to access the form.	Prevalence of paper information systems: hinders org learning capability
Planning Director	The concern physicians have with transparency is whether the data is valid.	Data reliability
Planning Director	The patient left the hospital on September 12th, [the medical record] goes to medical records and is coded by the coders in medical records. The data gets into meditech and it is held in meditech until the 1st of October. The 1st of October that data is picked up and sent into Eclipsis. On the 15th of October it is picked up by us, we run a report out of Eclipsis, and we send it to Premier. Premirer processes it and within a week sends us back an error report, and which within a week we have to correct... we don't know the zip code, we don't know who this doctor is, etc. By November 1st the patient data is audited and available for the government. They run about 2 to 3 months behind [the data].	Information timeliness Prevalence of paper information systems
Planning	We are unable to pull data from the OR as they are using their	Information systems

Director	own excel sheet systems and we have not been able to integrate that data.	integration
Planning Director	Leadership support for data transparency is very variable across specialties. Department like orthopedics, doctor [X] has been into data for a long time. I would say if there is a grand daddy of data collection at [Hospital XYZ] it is probably doctor [X]. In an access database. It is "their" access database, because that is the right adjective, and published papers with that data. They look at what we are trying to do skeptically.	Information systems integration *Prevalence of cultural silos: local leadership dependant*
Planning Director	This is a huge system that runs once a month and takes almost 4 days to get this data out. It isn't operational data	Information timeliness
Process Improvement Project Manager	The philosophy at [Hospital XYZ] is that for each individual application we want to get the best software and then afterwards we'll figure out how to tie it all together.	Information systems integration
Process Improvement Project Manager	The T system data isn't reliable because different nurses write their notes in different ways. Some write the notes into the T system immediately after the physician sees the patient. Others write the notes in a batch process and assign the same time of observation to every patient. It is very difficult to figure out what the precise timings are in each stage of the process.	Data reliability
Planning Director	Decision support data is finalized billing data. Because of the way healthcare is managed and billed there is a tremendous amount of detail that is captured in each transction. We use 250 fields from Meditech [...] All the measures that people want to do it nationally are based on something that everybody does. And in order to do that you need to abstract data from the chart, and use the same coding for the same procedures, everybody does that, it is called administrative data. All the national measures are based of administrative data. [...] All the care that we are supposed to provide and we measure are defined in terms of the core measures. Strict definitions, national definitions, about what you look for, what has to be documented, and what you are supposed to do. Pneumonia needs antibiotics 4 hours, a heart attack needs an aspirin, etc.	Workflow information system Patient record systems *External payer influence*

c. Senior Leadership

Senior Leadership External View

Interviewee	Interview quote(s)	Focused Coding
COO	There is a company out there that is part of hertz publications that is called Zynx, and they publish evidence based guidelines and are constantly monitoring the literature, and they have a collaborative workspace environment where groups can collaborate, modify, or change guidelines, and they have the ability to move you from what you should do to the evidence if you want to see why they are saying this is the right thing to do	Vendor influence/pressure
COO	And the other element is that out in the community, economically physicians are interested in throughput, so a complicated case even if they could do it, it means that it takes them away from churning out 20 cases, because those are the high margin low effort cases,	Provider referral/influence *Why community*

	when they get to high effort less margin, that is what they get to refer to the academic medical centers sometimes because it screws up their practice. So they don't want to deal with an obese person who weights 290 pounds who needs their gallbladder out, because something bad might happen, it is more complex surgery, it is riskier, so they rather deal with healthy people who need their gallbladder out, so they refer the complicated case to the academic center because it is not economically advantageous to them to do all those complicated cases.	*hospitals refer to them*
Chief of Strategy	Insurance companies, health plans, think about population based medicine, we spent a lot of time thinking about this when I was in the managed care side, and by that what they focus on is, "we've got a certain amount of money to take care of a population of patients and they think about what is the best way to invest that money to prevent illness, to screen and detect illness and treat it quickly before it gets worse than it needs to be, so if you look at the national measures of health plan performance, you see things like breast cancer screening or cervical cancer screening, or colon rectal cancer screening, or smoking cessation programs, and a whole bunch of that stuff, pediatric immunization, it is about either preventing disease or early detection and treatment of disease before it gets down the path, and a lot of management ideally focused on patient education self management and out patient management of chronic diseases like asthma and diabetes, you get an annual eye exam, an annual foot exam, you manage your blood sugar levels and all that stuff. [...] More on the preventive side and they have an incentive to do that because they want to keep people out of the doctors office, out of the emergency room, out of the hospitals, because each of those gets more and more expensive, and if in one patient you have to spend a lot of money on then you don't have much more money to spend on other patients, and it drives up costs overall. [...] Makes great sense from an overall financial perspective and from a population health perspective. I don't dispute for a second that the best things that we could do are to keep healthy people healthy, keeping them from getting sick, keep sick people from getting any sicker, manage the chronic diseases, those are the two best things that you can do. However when we have these contractual arrangements with insurance companies, in general, not in every case, but it is very difficult to make money within health patient primary care practice. That is not how we at [Hospital XYZ] make money. We don't make money from our patient primary care. We have a lot of outpatient primary care, but we don't make money from it. We would make more money from specialty care. We make our money from procedures, surgeries, from admissions to the hospital, so exactly the things that the health plans would like to prevent that is what we make our money from.	Payer system influence/pressure *Misalignment between insurance companies and acute care hospitals*
COO	We are going to find that some of these patients should not spend any time in the ED.	Patient behavior/impact
COO	There are a set of variables that patients are interested in and that you can define. And not every one of them is applicable in each situation. If you get to the emergency room now. Emergency rooms do a lot of things, and not all the care that the patient needs is given, even though they show up in the emergency room. So, first you have how patients come into the emergency room and their expectations,	Patient behavior/impact *Process complexity*

	because some of them come in ambulances, some of them are unconscious, and some of them drive themselves, and some of them come from work because they have a work related injury. So you have a whole different set of expectations	
COO	One of the other really unique things of healthcare as a service oriented business as compared to manufacturing is that our customers interfere with our operations and change the process, so if they come in late, or if they don't want to have their surgery and they rather have medicine… So unlike manufacturing where you own and control all the inputs and you put something together, in the healthcare case, the input is actually interfering with the process so it becomes a very dynamic role. So that is the second big thing that is important in healthcare. Our customer has a very big impact in our operational process and we have to understand that.	Patient behavior/impact *Service architecture management (internal and external)*
COO	It is very difficult to sustain healthcare improvements when you try to manage a process on top of the existing structure of healthcare. Healthcare is becoming more and more fragmented. Places like [Hospital XYZ] have a little better chance of making care integrated because we start with a group practice and so we collect data on our physicians both when they are seeing outpatients and when they are seeing inpatients, so one of the really fundamental characteristics that we have is that all of the data has always been practiced as a team, and whether it is in the inpatient or outpatient setting, we have had ways of keeping data together. So before we had electronic solutions we all wrote in one medical record and that stands in contrast if you go to [big competitor A] or the [big competitor B] where each physician group has an independent practice plan, and the hospital is an independent corporation from the physicians so what goes on in the physician office is totally unknown to the hospital, and what happens in the hospital that information is not in the physician office, and physicians communicate with each other so there is more than one way to get good care, so if you go to one doctor and he wants to send you the next he says "Hi Dr. Jones I would like you to look at Ms Smith, I have this irregular feeling in her abdomen. Could you please review it and let me know what you think?". Then the patient has to make a separate appointment to go to Dr. Jones office, where he may get some tests, and the doctor sets a whole new medical record in his office because that is all the information he has. Then Dr. Jones sends a letter of his findings to the other office and you store that. So having that information together we have this integrated view of the world, but the rest of the world is pretty fragmented and if you are out there in a community hospital and see Dr. Jones, and he wants you to get an X-ray, you have to call up the hospital to get an x-ray, wait in line, tell the hospital to send it to Dr. Jones, then Dr. Jones sees you again and sends all the information to another doctor, etc. So it is a fragmented system to begin with.	Industry history, evolution, and context *Points towards how Hospital XYZ perceives its competitive advantage (integrated, single record, etc).*
Chief of Strategy	For some time, we were the primary care provider but we would have staff for when someone would want to go to a doctor outside [Hospital XYZ], we would call them up and work with them to see if we could meet their needs inside [Hospital XYZ] and keep them there. We got rid of those positions now because we don't need them. Capitation has gone away so we no longer have the incentive to keep them here for everything.	Payer system influence/pressure *Extended enterprise management (payment changed, so enterprise boundary changed)*
COO	We have a tremendous amount of mandates both legal and moral in	Regulatory

	terms of our quality. In addition dminis we are trying to improve the quality of care. It gets very difficult to sustain a change for an extended period of time in the healthcare system.	requirements and oversight
CFO	Whatever path one might take, the administrative simplification is important. If you think about the healthcare about the healthcare dollar today, 10 cents on every dollar goes to pay the insurance company overhead and Administrative cost, and when it comes to the provider community in the hospital 50 cents goes to some sort of overhead, and the physician practice probably comes to 20 to 25 cents of overhead, you think about what is left over for the patient and it is really a little amount. Everything we have come up in this industry is complex on the administrative side.	Payer system influence/pressure Industry history, evolution, and context
CFO	Another failure of capitation was the inability to really track what was going on, the lack of predictability, the health plan information was six months off because they didn't share information among themselves.	Industry history, evolution, and context *Capitation failure*
CFO	One of the things that I seem to struggle with all the time I speak with health plans and they don't get there is the fact that how they pay us holds no relationship to what it costs us to deliver. So if you look at [Hospital XYZ], we have the hospital in patient practice, a hospital outpatient inside practice, and physician group practice, and [large health insurer A] likes to put their money in the hospital in patient side, I think they think they can control that better because it is lower volume, then the hospital outpatient has the next grade of payment with the doctors at the bottom end of the scale, and [large health insurer B] might be completely the other away, and [large health insurer C] might be somewhere in the middle. If you are trying to manage an institution, let us take a look at our department and see who the winners and losers are... it is a function of where insurance companies are putting their money, it is not a function of how well the physicians are performing, or how productive they are, or how efficient they are, so we look at this and say we have to be careful about what type of decisions the insurers make. So we have tried to explain that to the health plans, in saying that we are trying to manage the business we would like to be able to apply our cost accounting standards and look at our reimbursements to truly understand how we are doing in our different areas in the organization, and at the end of the day we end up having to take wherever the money will come from, and I am certainly not going to say that we don't want all this money to go into inpatient because we are making a profit there and you are not willing to give it to our group practice therefore we will forego it, so at the end of the day we take whatever way we will get it, but at the end of the day I would like to see a better distribution of how the payments get made in that regard, and I am sure we are probably not alone in that analysis.	Payer system influence/pressure *Different insurers reward more favorably different types of care* *Financial numbers not indicative of performance* *Strategy dilution*
COO	On the cost side, both the employers and the insurers… there is no system of care. As I say, what we have now are random acts of clinical improvement where people decide this year we are going to work on this, this year we are going to work on that, … there is no systematic approach to healthcare in the united states, either by the government or by the healthcare industry, and that is a real problem. And there are models of improvement that could be applied to healthcare, which basically say that you start with the sickest people, then you move to the less sick, then you move to wellness, then you	Industry history, evolution, and context Payer system influence/pressure *Lack of direction in the US in terms of*

	go up to the top. And those are effective models that could be approved and applied to healthcare. But there isn't any. It could be AIDS advocates that get the government to spend a zillion dollars to this, or breast cancer, or heart disease… From the insurers again, there are short term savings which have to do with end of life issues and admissions to the hospital. There is a long term strategy which is keeping people well, so where you want to save your money is very… trying to understand your goal is very critical on that regard. It is not all the same. The strategy to save a lot of money in the short term with the patient is much different, and society is much different, than saving money in the long term as a strategy. We are just shooting like a shot gun all over the place and there isn't any systematic rationale. Wouldn't it be great if the united states said ok we want every state to focus on diabetes, and we are going to reduce, everybody is going to be incentivized to just improve the entire quality of our diabetic population, or obesity, or pick anything that you want, until you reach this social goal. And we are going to take every tool that is available to us, in every state in the united states,… or we are going to focus on the sickest patients who account for the most money… or we are going to try to keep everybody well in the next five years so that they get less sick.	*what to improve on. Different payers focus on different things. In a way fueling Hospital XYZ strategy of focusing on multiple things.*
COO	The other element is all about brand. If [big competitor A] is perceived to be best than [Hospital XYZ] for this kind of procedure, but the objective data says that they are the same. America is built on advertising and brand recognition, so I still want to go to that other place because in my mind they are better, or they demand more money in the market place even though they are less efficient.	Patient behavior/impact *Enterprise strategy* *Reputation*
COO	what is happening now is that we have 15 different things that everybody is asking us to do, and they are not all the same, and they are all trying to tie a reward to them in pay for performance. […] the government is doing it the slightly in the opposite way which says, if you don't report this we are going to pay you a little less	Payer system influence/pressure *Strategy dilution*
COO	If the word gets out that we have the best product at the lowest cost out in the retail world people will buy what we have and more people will come and I will make a bigger profit and that is sort of how it works. But in the healthcare world if we are more efficient than the [big competitor A] there still isn't any way of driving more business to us. Suppose our quality is the same as the one provided elsewhere but we can do it for less, society should figure out a way to reward us and try to have people come to us for less. But that part of the equation is still missing a holistic view. What the insurers want to do is drive the patient to us, so that the cost will go down to our cost, not to allow us to increase the margin. […] what the government and the insurers want to do is if they pay us [Hospital XYZ] 15K in order to survive, we figure out how to do it for 10 K, once they figure out we know how to do it for ten they lower the reimbursement from 15 K to 10K and say that we [Hospital XYZ] are making too much.	Payer system influence/pressure *Ability to negotiate with insurers. No incentive to become efficient because insurers take that margin away.*
COO	If in the long term you want to keep people healthy, like diabetes, that can take up to 20 years to realize the savings, because you don't get the eye disease, or you don't get the vascular complications,	Payer system influence/pressure

	things like that... so in the high risk patient population management side, the notion that 5% of the patients account for 40% of the cost, it is not a Gaussian curve... if you manage that % of the population you actually get the immediate savings and the per member per month cost for those people are 1200 to 1300 per month compared to 60 or 70 for a healthy person... so during capitation that is something that we did, and we actually did it so well that Blue Cross didn't believe that we should make all that money under capitation and then we had our little... [pause] experience. This model was designed to keep patients away from the healthcare system. We take care of sick patients really well, but the goal is to keep them away from the healthcare system because as soon as they get into the healthcare system they cost a ton of money. And that is a different business of what we do.	
COO	For us [Medicare] represents 45% of our business. That is a lot because in [our State] we have a lot of elderly people. In other parts of the country it may only represent 15% and there may be parts of NY city, or other places, where it might be 55%. But the national average, probably I bet, less than 20%.	Payer system influence/pressure
COO	If you are an academic medical center the other issue is teaching costs. The only insurer that actually itemizes a certain amount of cost that a payer that pays for teaching people is Medicare. No private insurance includes for those hospitals that have teaching programs any additional negotiated cost for the teaching program. So Medicare has the burden for paying for all the teaching. And they obviously keep cutting the cost so we have to try to figure out again how we can negotiate rates around our private insurers to overcome that and include the teaching cost, but the private insurers will not acknowledge that there is such a thing as a payment structure for teaching. So Medicare is the only insurer that identifies a certain amount of money and a formula, based on how many residents and fellows you have. But it is not limitless. They set a cap. And at [Hospital XYZ] we are over that cap and we have to eat the cost of all the additional people.	Payer system influence/pressure *Enterprise strategy: Teaching / cost shifting*
COO	Then there is the government that has a big say on what happens. The government overnight can change healthcare from both a regulatory and a payment structure. It has that much influence.	Regulatory requirements and oversight
COO	Now the way the healthcare system works Medicare continues to underpay. We lose money on Medicare patients in the united states. So the private insurers. We have to negotiate more money for them to cover the losses we have for Medicare. They get their money from the employers. So basically the employers are paying higher premiums in order to subsidize the governments health insurance program. And that is the current state of the model certainly in [US region X] and probably in the US in general. We need more than Medicare in order to cover the cost of the enterprise and that comes from the payers. Now the insurers charge people premiums but the employers pay on a claims based program, and the insurance companies make money on the float, so they get all the premium dollars coming in every month and they invest it, and then as claims come in they send the bill to the company based on the claim, and the company pays the insurance company any difference. And then every one of the companies has a whole series of consultants that are constantly trying to sell them a better way to	Payer system influence/pressure *Enterprise strategy: cost shifting*

	save money in their healthcare, from the insurance companies and us. So that is a whole other industry that they in order to continue to exist, those consultants, they have to work with the benefit managers of the companies and say to them "why don't you do that to the providers!", "why don't you cost shift that to your employees", or "why don't you do that to the insurers".	
COO	we are fee for service… but the way the government pays… the way Medicare pays for a hospitalization is a DRG, so they give you a fixed payment based on a severity index, so if you are more efficient than the average, meaning that your length of stay is lower for instance than what their payment is based on average, then the odds are you will be able to have a better margin. And if you have fewer complication etc…	Payer system influence/pressure
COO	Financials we do have obviously metrics… and those relate obviously to the way that we are currently paid	Payer system influence/pressure
COO	[JO: What are some of the main regulation changes that had a significant effect in the way that you provide care?] One of them is HIPAA, privacy act, in the recent past. The second is public reporting requirements. The third would be payment structures. HIPAA made things better. Public reporting requirements made things better. I believe in those. The payment structure is mixed. It is better because in some areas where we all agree that we have good measures the idea of paying for performance makes sense. Where it is bad, is that people are saying that but their real goal is just to reduce cost, not to really provide better care. Where it advances safety and quality and performance it is good, but where it is a way to save money, from our perspective, it is not good. And sometimes the payment structure has a perverse alignment, where it rather than achieving what it desires it actually incentivizes… it either puts in conflict physicians and institutions, or it incentivizes the wrong behavior. […] [JO: Do you feel that you can influence regulation?] [interviewee pauses for 30 seconds] I don't know the answer to that. I would say that I am an idealist so I would say yes. But I think that regulation occurs, and I think there are mechanisms where we do have input so I would say yes. Do I think that we have an opportunity to regulate industry sufficiently. That we have as much clout as we should have in terms of protecting our patients, no. Yes we have an opportunity to influence regulation. Is our importance reflected in the weight of that, I would say no.	Regulatory requirements and oversight Payer system influence/pressure
Chief of Strategy	[community hospital X] were facing tremendous pressure from [downtown hospital network], "send those referrals to us or you are out of our network".	Provider competition pressure
Chief of Strategy	If you go to the emergency room because you have acute abdominal pain, if they discharge you, and you go home, you might pay a $50 or $100 co-pay if you've got an HMO, but if they admit you and then remove your gall bladder you don't have to pay anything. It is probably a covered benefit. You are not going to pay a co-pay for the emergency room if you get admitted, so no consequences… which is not to say that it is an elective thing. So the system we have has disconnected the consumer from the financial consequences.	Patient behavior/impact
Chief of Strategy	we [Hospital XYZ] negotiate with [lists 6 large insurance companies], etc and so we have lots and lots of different contracts	Payer system influence/pressure

	and the way the contracts are scheduled and the fee schedules, it could be that 10 different people come in to get an MRI of their hip and we can get reimbursed 10 different amounts of money for the exact same MRI because there are contractual differences across the different insurance companies that we have contracts with. Managing that complexity, and they each have got computer systems configured to do this, because they have got a contract on the insurance side, they have got a contract with us, they have got a contract with [big competitor A], and guess what, the contract is the same, not the same amount, so they have to configure once the bill comes in which benefit plan is it, who is the provider, what is our contract with the provider, what should we be reimbursing. We have different contracts with different insurance plans, they have got different contracts with all the different provider organizations, and they may have different contracts because on the insurance side some employers will buy particular insurance products, other employers will say I am going to be self insured and I don't want you to insure me and I just want you to process the bills, so there are going to be administrative services only	*Hospital XYZ negotiates different prices for the same procedure for different insurers.*
Chief of Strategy	So you have the health plans and they have tremendous power because they control the flow of the money from the employers, who really don't know much about health insurance, to the providers. And from an overall system efficiency point of view I will tell you that a single payer system would absolutely be the most efficient system. The health plans are just taking the money out of the system to do administrative work. When I was in a health plan, there are some thing they do and they are important, but I will come back to that. When I was working in managed care I actually thought we had an impact on quality of care. I was deluded. When you come here you realize that the payers are virtually invisible when it comes to the impact on the quality of care. The exception is where we have pay for performance programs, they are financial incentives pipelines, namely where we negotiate with an insurer that we are going to do X, Y, and Z, and if we achieve certain performance targets they will give us additional reimbursements beyond our contractual agreements. So beyond that, they are invisible.	Payer system influence/pressure *Insurance companies only represent administrative cost. Only direct impact on improving things is via negotiated pay for performance contract clauses.*
Chief of Strategy	The other place they [health plans] tend to get involved, though consumers tend to push back, is if they have pre certification or approval requirements, you know before you can have that operation the case manager or insurance company needs to approve it, before you can have the MRI you first need to decide whether it is medically appropriate, and that is the only other place they get involved. But by enlarge their power comes through the fact that they control de flow of money, they don't really impact quality of care on a very significant scale.	Payer system influence/pressure
Chief of Strategy	when Medicare sees utilization of something climbing they say "Ups we have got one pool of money, a finite pie, we see utilization of something going up, we reduce the reimbursement for it.". It doesn't matter if the demand is there, if the need is greater. There is no discussion.	Payer system influence/pressure
Chief of Strategy	what we are going to pay. Because that is their size… that is federally legislated… and done. There is no negotiating. Which is one of the reasons why private employers are subsidizing Medicare and Medicaid in a big way. I mean that is one of the dirty little secrets in healthcare. They are subsidizing… the rates we charge… we have to make sure from a provider end… once you get to the	Payer system influence/pressure *Cost shifting*

	provider end... the providers have to make sure they get rates from the commercial health insurers that will not only cover their cost but generate a margin to subsidize the things that we do for Medicare and Medicaid or we lose money.	
Chief of Strategy	Insurance companies know who are the frequent flyers and they have programs in place to manage those people. We used to when we were in capitation, we had a program in place to manage our capitated highest risk, high volume utilizers, they are usually people with multiple chronic conditions and they are in the top 1% to 5% in terms of utilization, consuming 20% to 30% of the resources.	Payer system influence/pressure *Hospital XYZ used to curb patient behavior in a capitated environment*
Chief of Strategy	5 years ago no community hospital was able to perform a cardio angioplasty procedure, however it is becoming more of a commodity nowadays, so community hospitals are being able to perform them.	Industry history, evolution, and context *Commoditization of medicine. Pressure to remain cutting edge*
Chief of Strategy	The economic reason to do the reengineering of healthcare... Premium rate increases that the insurers are charging employers, they have been double digit increases every year, but it will come a time when they will be binned into single digit. When that happens our expenses will outpace our revenues because medical inflation, because drug alluded stent $3000, versus a plane stent of $800. Laparoscopic surgery is less invasive, faster recovery, back to work faster, who reaps the financial benefit of that, not us. Laparoscopic surgery the supplies are more expensive, you are out of the hospital faster, the OR time is more, so it is a longer case and more expensive case, you are back to work faster, you get a shorter length of stay, and we get paid less of a DRG. The economics drive the imperative to constantly find ways of doing things more and more efficiently and at lower and lower cost just to survive. If you don't find ways of doing things differently you are on a collision course with the flattening out of the premium reimbursement rates of insurance companies.	Industry history, evolution, and context Payer system influence/pressure
Chief of Strategy	We have many different goals which has partly confused the improvement effort because the improvement effort can be the same, I can want to improve congested of heart failure in my hospital A, and someone can want to improve congested heart failure at hospital B, but the customer they are doing it for can be completely different. In some cases they don't even know who the customer is, they are just doing it because CMS is not going to pay you unless you get better.	Payer system influence/pressure *Strategy dillution*

Senior Leadership Strategy View

Interviewee	Interview quote(s)	Focused Coding
Chief of Strategy	We are never going to have pathways, standard orders, evidence based treatment recommendations, whatever you want to call it, for everything. It is not going to happen. There are always going to be either patients that are so complex. We don't just come as a diabetic, or come as a patient with hyper tension... you may be a diabetic that has hyper tension, high cholesterol, and maybe a bit of asthma, who knows! All the evidence based guidelines those are all about "this is	Enterprise Strategy *Cutting edge starts at Hospital XYZ*

	what we do for diabetes", "this is what we do for asthma", "this is what we do for COPD". Those things are developed for diseases not for people. And then there is going to be cutting edge which will introduce variability to improve.	
CFO	From a realistic perspective, politically it would be a hard sell here probably [to hold back on the new ED] because the CEO getting in and even long before the Board approving the project, told the whole department "you are getting a new ER". He was way ahead of the rest of us, and probably, I wish he hadn't gotten so far and so fast. I would love that most, if not all the time, decisions were made based with good sense and facts, but unfortunately politics don't lend themselves to that.	Enterprise Strategy *Politics rather than common sense*
COO	And then we targeted a growth strategy for key specialties or service lines. That is another thing I did 7 years ago, where I divided the [Hospital XYZ] up into service lines which now people are starting to talk about. So we had a cardiovascular and a neuroscience, a men's health, a women's health, and a cancer service line, and we basically targeted growth in those areas where we thought that epidemiologically played to the public and also where we could be very strong.	Enterprise Strategy
Chief of Strategy	when we have these contractual arrangements with insurance companies, in general, not in every case, but it is very difficult to make money within health patient primary care practice. That is not how we at [Hospital XYZ] make money. We don't make money from our patient primary care. We have a lot of outpatient primary care, but we don't make money from it. We would make more money from specialty care. We make our money from procedures, surgeries	Enterprise Strategy
Chief of Strategy	At the heart of it all [Hospital XYZ] is something that is unique in its market place. We are an integrated multi specialty group practice. Ten years ago there was all this talk about integrated care delivery groups and we were already an integrated care facility. There were all sorts of mergers and affiliations all designed to cobble together the different parts of [Hospital XYZ], potentially a very fragmented healthcare system	Enterprise Strategy *Industry history and evolution*
Chief of Strategy	We are really trying to serve two big categories of patients. We provide comprehensive care, primary care and tertiary care, for people who live within 20 miles, we can offer you everything that you need in a convenient way. We are not down town. We are located out of highways. Then in certain targeted areas, where we believe our clinical expertise is so good that we can do this, we are a regional and in some cases national center of excellence, to serve a population that has the need to serve such subspecialty services and is willing and able to travel to get it. We cannot easily break down the revenues from each of these two groups. 80% of patients come from [our State]. 10% come from [northern State] 5% come from other [adjacent States], and the other 5% from other parts of the country.	Enterprise Strategy *Strategy conflict* *Most revenue from state*
CFO	I wonder if there is enough new activity in the new ED to pay for a $25M project. This is a heavy weighted project... I still can't get over the $25M... I have seen the presentation 2 or 3 times and it is not the presentation wasn't good, but when they go away, my mind still says to myself "that is an awful lot amount of money for this amount of space".	Enterprise transformation strategic scope *narrow thinking that ED has to pay for itself* *service architecture awareness*

COO	One of our ways to develop a specialty network... On selective ways we opened up our technology to attract private physicians to bring their patients and we would allow them to use our technology provided that they had the training or could be trained. This was different than the [big competitor A] or [big competitor B] model who considered their doctors a different breed than everyone else and that only they could operate with the cutting edge technology. We allowed specialists in the community to use the [Hospital XYZ] technology that wasn't available. And we did the other thing where if there was a gap in the medical staff in the community hospital, we sent our specialist out there, to cover the emergency room, do local cases in the local hospital, and bring the complicated cases back to [Hospital XYZ].	Enterprise Strategy *Enterprise history and culture* *Extended enterprise management*
Chief of Strategy	[Close by Community Hospital] sends cardiac patients here, the medical director of their cath lab is Dr. X, our chairman of cardiology, they send us angioplasties, they send us open heart cases	Enterprise Strategy *Extended enterprise management*
Chief of Strategy	Another thing we will do is to partner with other facilities and partner with other physician organizations, and have[Hospital XYZ]physicians go do work in other places in areas where it complements the other organization. When we do that we give something to them but we also get something back. The best example might be neuro surgery since there is a shortage of neuro surgeons in the market place, we have six or seven neuro surgeons here. [Community hospital X] has no neuro surgeons. We worked out an arrangement with Emerson hospital where two of our neuro surgeons go there, they have a clinic there one or two days a week, they will do some minor neuro surgery patients at [community] hospital and their OR, any complex cases they bring back here. We are talking with other hospitals to get our neuro surgeons there. The reason we can do that is that they are able to handle some neuro surgery cases there and meet the needs of the community they serve, and we get referrals for the complex cases that come back here. We get to build a stronger and larger neuro surgery department because we already have a critical mass, and are more attractive practice for a neuro surgeon to come. We have a leg up on the community hospitals to hire neuro surgeons and are more successful at it, but then we can partner with the community hospitals. We don't want to put the community hospitals out of business because we don't want to do all the stuff that they do. But we can do things that will complement them. And what we rather do is more tertiary services.	Enterprise Strategy *Enterprise history and culture* *Extended enterprise management*
COO	If you look at the other models of the [big competitor A], the [big competitor B], and [competitor C]... over 150 years they have trained all of these fellows, and then the fellows go out and practice in the community, and they know the professor who trained them, and if there is a patient they can't handle they refer to him. So these referral channels...a significant number of those referral channels come in because you train fellows and they go out in the community and they know you and they refer back. And another set get referred in because your reputation grows as a physician and as an organization and people say "that is the greatest place in the world to get your heart done, I'm going to go there, don't know any doctors but everybody says that they are great so I'm going to go there". Now [Hospital XYZ] was very new and it didn't train a lot of fellows at that time so those relationships are built at a physician and physician level based on trust. So if we put our physicians there, and they refer a patient to our doctor, the patient is seen quickly, the medical care	Enterprise Strategy *Importance of training doctors*

	provided is excellent, and our doctor communicates well with that physician, and the patient comes back and says "I had a great experience, that was a great doctor" they are likely to refer another patient.	
COO	And another set get referred in because your reputation grows as a physician and as an organization and people say "that is the greatest place in the world to get your heart done, I'm going to go there, don't know any doctors but everybody says that they are great so I'm going to go there". [...] [Hospital XYZ] is known as a diagnostic center where if no one can figure out what is wrong with you, you should come to the [Hospital XYZ]. And also for tertiary and quaternary care at a very high level surgical as well as medically the excellence of very complicated difficult cases.	Enterprise strategy *Enterprise history and culture*
Chief of Strategy	We cannot afford to let go the big chunk that we get from our own [surroundings and State]. There are not enough liver transplants in our market to justify the expense and keep busy for liver transplant surgeons. So in that case you have to drive from the big market. If you look specialty by specialty it varies the extent to which they drive from the smaller geography or the much larger one.	Enterprise strategy *Geographic reach*
COO	I think that our goal is to advance the model of care that provides the best care to the citizens of the united states, and do that in a way that we can survive currently, but anticipate that that model will bring us even stronger financial results as the payment system gets aligned to that model. And we think... I personally believe that multi specialty group practices is where America will find its model for care, and really needs to think about how it can realign the payment practices to support that model.	Enterprise strategy *Hospital financial incentives*
Chief of Strategy	Well, it is still an HMO, but you can go anywhere, and we don't get paid based on capitation. So our incentive is to work to attract patients to the services that we excel in and that we make a better margin from and that are really core to our mission. So we can grow those services. But for example, since primary care is not the most lucrative thing, we don't want the biggest primary care practice around, we would love to have one of the biggest surgical practices around, and so we are focused on growing and attracting patients to that because patients have choice. They can go anywhere and they can come to [Hospital XYZ]. In fact it is part of our advertising campaign because for a while people were convinced by their doctors that they couldn't go outside their doctors network and you used to think that you had to be somebody special, or that you had to belong to [Hospital XYZ] to come here. In our adds we say "Do you have to be somebody special to come to [Hospital XYZ]? No. Anybody can come to [Hospital XYZ]. Just call this number or go to www.whatever".	Enterprise strategy *Hospital financial incentives* *Payer system influence: if primary care was lucrative they would invest in it*
Chief of Strategy	The reason it [capitation] fell apart is that to do that we really need to be responsible for all of their care. We can do everything except obstetrics, so we don't want them going to Winchester hospital. So we don't want them to go to a gastro enologist that is outside of [Hospital XYZ]. We want all of their care to be in the[Hospital XYZ]system. And that created boundaries and barriers that the patients didn't like, and the patients rebelled against it because it restricted their choice, and then pushed backed on the insurance	Enterprise strategy *Enterprise history and culture* *Capitation failure*

	companies and employers, and capitation is now dead. Gone. We don't have capitation any longer. Here by enlarge in this state capitation is dead.	
Chief of Strategy	So I think it is a matter of how we provide choice. How we align the incentives of the providers and the payers focused around keeping healthy people healthy, keep sick people from getting sicker, and for those people who have some sort of acute problem, treat it as efficiently as you can with high quality. Integrated group practices are better positioned to do that. To manage quality and safety efficiently, to have operational efficiency. If you go to [big competitor A], to align all the stakeholders you would need to... well the emergency room might be the easiest because the emergency room docs, and the nurses in [big competitor A], work for [big competitor A]. The surgeons don't work for [big competitor A]. The people in outpatient clinics or in outpatient practices, who might send people to the [big competitor A] emergency room don't work for [big competitor A]. So all the stakeholders in [big competitor A] aren't part of the same organization, whereas everybody here has the [Hospital XYZ] logo on their pay check and one way or the other ultimately is accountable to [Dr. X] our CEO. So we can align things much more easily than in other situations and we have an incentive, since we are all part of the same organization, and whether there is an annual merit increase and things like that, we all have the same incentive which is for the organization as a whole to be successful. And even if we don't have a huge personal financial incentive, we have the incentive for the organization as a whole to be successful so that we have the capital to reinvest in new technology, new space, and so forth.	Enterprise Strategy *Integrated multidisciplinary organization better able to align itself to payers*
Chief of Strategy	We want to be the provider. You wont see it written down like this. There are a bunch of goals about quality and safety, and investing in technology, etc, some of that is about sustaining the organization. But our growth priorities really have to do, if you want to think in terms of market share, or patient volume, our growth priorities are really in those areas of sub specialty expertise where we are and want to remain and grow even stronger as a center of excellence. So we are focused on cardiovascular services, we are focused on neuro sciences, we are focused on cancer (we are behind there in terms of our plans and our goals because we have been without a chairman for a long time to drive that). So we want to be the provider of choice in certain areas of expertise and there are various strategies we have in place to do that. We believe that we have to grow to survive.	Enterprise Strategy *Strategy dilution* *Focus on growing surgical procedures*
Chief of Strategy	One is expanding, by hiring more doctors, expanding the facility and our capability here, in [location X], if we think people are going to come here for it.	Enterprise Strategy
Chief of Strategy	Another is providing the service closer to where people are. So we are expanding. [...] we are now looking at another expansion because we think we can grow much more. However we are being careful about what we are going to put in that building. We are going to put more sub specialty diagnostics expertise in the areas we want to attract patients. There are other community hospitals in that market, and we don't want to do what they do. We don't want the heart failure patients, we don't want the pneumonia patients, let them do that because that is what they are good at. We want to attract the patients that we think we can best serve.	Enterprise Strategy *Not to compete with community hospitals.* *ED acuity level 3 patients not the target population*
Chief of	We have always been, since 1980, an integrated facility with	Enterprise Strategy

Strategy	outpatient practice, primary care, comprehensive diagnostics, inpatient care, ED, ORs, ambulatory procedures, all in one organization, all under one roof, the nurses, the doctors, the administrators, all work for the same organization, so that when the CEO signs the contract he can speak for 450 different physicians. When you walk through our door, anything you might need, we can offer under one roof. [...] [big competitor A] as a hospital is not a group practice. You walk down the hall and talk with a doctor, today might be faculty from the medical school so they get their pay check from the medical school. Today might be lab technology or radiology reporting to [big competitor A]. They might be member of an external group with privieleges at the [big competitor A]. They might be a community physician that has privileges at the [big competitor A]. They don't all work for the same organization. When the CEO of the [big competitor A] signs the contract he cant guarantee that all the doctors and all the nurses are all going to line up. They work in different organizations. They may or may not be on the same team. They don't necessarily eat in the same cafeteria. [big competitor A] is a workshop for many of the doctors that go there, they don't live there, it is a place where they do some of their work to drive some of their income, but they are not part of the whole organization. [...] It also means we have one medical record, so that if you go see your cardiologist today, and you are going to see the orthopedic surgeon tomorrow, and you are going to see the gastro enrologist next Wednesday, there are all looking at the same medical record, whether it is paper or electronic, they all have access to the same information. So we have an integrated medical record and we have one scheduling system, so that you can call one number and talk to one person, and schedule three different appointments from three different specialties, all in the same day. So we believe that we offer something that is different from what all the other people offer. All the care you need under one roof.	*Integrated provider* *Single medical record*
Chief of Strategy	We have for years practiced team based medicine. And that manifests itself in a number of ways. The doctors go to the same cafeteria, they go to the same meetings, to the same committees, the paycheck has the same logo on it, and so they know each other, they work together, they consult with each other, the bigger the organization has gotten, the more challenging it is. Any [Hospital XYZ] physician, on a moment's notice, if it is necessary, can get to the bedside or the exam table, any specialty that he or she might need. If is not that urgent they can make sure you get seen within a day, three days, within whatever they think it is necessary, by a colleague. If you have an internist in [place X] in private practice, and he is going to refer you to a dermatologist in [place Y], and they don't work with each other, you are not going to see him in 10 minutes. It may be up to the next 3 weeks, or whenever their schedule allows them to. It is not the same as [Hospital XYZ]. So people here view[Hospital XYZ]patients as[Hospital XYZ]patients, and not as doctor XYZ patient.	Enterprise Strategy *Team based medicine* *Describes collegial and available environment between specialties.*
COO	In capitation you are paid by the patient, so the more lives you cover, the more money you get every month. You get so many dollars per member per month to help take care of people, and you need to have	Enterprise Strategy *Enterprise history*

	a large number of lives, because if you just take care of sick people you lose your shirt, and **if you don't keep growing and adding people you risk your population just getting older and sicker**. So covered lives became important and geography became important. Because when you go to insurers you want to take care of a geographic area, that the larger of that area the more you can try to generate from the insurers because they need you to take care of people. So geographic spread and covered lives was how you made your money. [...] Capitation aligned things very well with the patients, but the way it was implemented by the insurance companies, there was a lot of utilization review, a lot of meddling, a lot of trying to avoid payments.. it was not a very pleasant thing for providers to be in. [...] Some patients considered us their primary care physician even though they were on the [remote region X], and so if they had an emergency and went to [remote region X] hospital, we had to pay [remote region X] hospital's charges out of our capitation. So if you can't 100% control everything about the patient and you are capitated you lose your shirt. Even though the insurance company told us "you can manage the patient" they would tell the patient "you can go wherever you want to go" [...] The insurance plan still kept privelaging and credentialing, they kept case management, they kept managing the money, so they never delegated. **So it didn't work for us... it was a disaster**. We were left with this large network and one of our strategies was to get out of capitation as soon as possible	*and culture*
Chief of Strategy	So we get paid based on encounters, visits, surgeries, admissions, procedures, colonoscopies, angioplasties, we get paid based on volume utilization and so that is what we count, it is what drives our revenue.	Enterprise Strategy *Hospital financial incentives* *Paid on volume (i.e. patient encounters), not on patient continuity (service view)*

Senior Leadership Service View

Interviewee	Interview quote(s)	Focused Coding
Chief of Strategy	When they measure things at the health plan, they measure things "whatever per thousand patients". When I came here our measurement systems aren't about patients at all. It is not about individual people. We don't measure patients. We measure encounters. We measure visits to the outpatient clinics by department. We measure visits to the emergency room. We have 36,000 visits to the emergency room per year. I can't tell you that it is 36,000 people, if it is 10,000 people, or if it is 5,000 people. I am certain that we have some frequent flyers who over the course of the year are here 10 times and we have other people who are here once or maybe once every three years, but the point is that we don't measure people. We measure use of our system.	Service continuity (patient care) *Measurement geared towards system use, not patient*
CFO	The problem is that [Chair of ED], and others, only control what is inside their environment, so he can make that commitment and	Service architecture management

	implement what he can in his environment, but the things that he doesn't control which are probably equally as many things as he does control, he may not be able to implement, if we don't influence it early.	*Dependant on boundary of control*
COO	Average length of stay is 4.6 days, including solid organ transplantation, and no psych and no OB. One of the theories we have in terms of looking at the whole enterprise, is not just getting out of the ED, it is getting out of the hospital. One of the things that we have found is that there is a body of consultation and testing that is part of the ED workup before the patient gets to the floor, and what we have found is that if the patient needs a CAT scan while they are in the ED, through a care process map, or just being in the ED, getting that test done is basically the single build mode. We have great concern that if the goal is to get them on the floor quickly and then order those tests, that then they become in the large queue for the whole hospital with all the other patients that needs whatever and in the end the length of stay for that patient in the hospital is smaller. Having the patient doing those tests in the ED really saves us time on the LOS.	Service architecture management *Confirmation that ED used when inpatient services could be used instead*
COO	If you have a heart attack today, people feel that within 90 minutes you should be in a cath lab and have a stent put in, once you show up. So having interventional cardiology due to myocardial damage is one thing that needs to happen right away. If you are a trauma patient you need to have done whatever you need to have done immediately. If you have a stroke and if you have septis, that is you are in shock because you have an infection.	Service sustainability (patient experience) Service architecture awareness / appreciation *Recognizes that critical care patients for inpatient specialties come through the ED first*
COO	Some of them are simple, like the patient might say, I have a cut and would like to be seen right away and like to get the hell out of here in one hour. There are categories: I want access, I want accountability (meaning I have people who took care of me, I have people who are going to take care of me, I want communication), I want a good outcome (I don't want to have any trouble when I leave). That is a simple one. If I want a stent I might pass through the emergency room and go right up to a cardiac cath lab, I have all kinds of issues about informed consent, about my loved ones knowing what I am doing and where I am going, all this is part of our customer service piece for the patient. I want to try to understand, or have my family and loved one understand what my options are, the doctor is going to tell me what he is going to do to me, so again it is access, communication ability	Service sustainability (patient experience)
COO	the doctor: I want to have all my tools, I want a room, I need XYZ… again the tools might be different, dminis process in terms dmini expectations dmini inputs, my tools, my medications, the different technical personal, the availability of a suite dmini dmin the procedure I am doing, the support in terms of radiology and laboratory	Service sustainability (patient and physician experience)
COO	When someone has a code… you are on a bed and suddenly go uncounscious… we do a single build model, we have a code team, people all over the hospital that has expertise in dealing with the	Service architecture management: single build vs sequential

	code, and we call that and the whole team comes to you. You get all the care you need to do with that code. And if we are going to do an intervention on your heart or trauma we do the same thing. We take you into the operating room, we bring everybody there, we try to work on you and figure out what you are doing. On the other hand if you were having elective knee replacement, and you go to the lab and you get your test, and then you go to radiology, and then you show up at the pre op and they take care of what they do, then they bring you into the OR, they take care of what you do, then they bring you to the recovery room, and they put you on the floor. We don't do everything at the same time as in a single build.	build (i.e. mobile cell vs flow)
Chief of Strategy	We don't measure patients. We measure encounters. We measure visits to the outpatient clinics by department. We measure visits to the emergency room. We have 36,000 visits to the emergency room per year. I can't tell you that it is 36,000 people, if it is 10,000 people, or if it is 5,000 people. I am certain that we have some frequent flyers who over the course of the year are here 10 times and we have other people who are here once or maybe once every three years, but the point is that we don't measure people. We measure use of our system.	Service continuity (patient care) *Non patient centered enterprise. Unable to measure as such due to existing IT capability.*
Chief of Strategy	The other place that is feeling the pain is the OR. Upstairs is full and the OR backs up. The last thing a surgeon needs to hear is that you cannot do your next case, because we cant get this patient out of the OR, because the PACU is full because no one can be sent upstairs.	Service architecture management *OR feeling the pain*

Senior Leadership Process View

Interviewee	Interview quote(s)	Focused Coding
CFO	We have the means to show the variability of expenditure by procedure by physician... we have done a little bit of it, but what little we have done we are getting a lot of push back from the physicians, they don't want to be measured individually, they want to be measured as a group. It is amazing, once you are performing up here [makes a sign with the hand at high level] I say to them "I can't believe that you guys even want to let the ones who are down there be down there. Why should you be carrying those guys?". But they seem to be okay with it. [...] Leadership has to decide what it wants to do, to help communicate that to the staff physicians, and I don't think they are there. I don't think they are there. I still think the physician leadership still sides with the staff physicians. The administrators may want to provide more transparency, provide more information, try to get these guys to understand what their contribution is or isn't, and that there is opportunity to improve, but we don't have a physician leadership thinking that way. So there isn't a meeting of the minds between the two groups, and part of that is that we are doing well and so there is no sense of urgency.	Process enterprise measurement capability
Chief of Strategy	We have not been talking about process reengineering generally with the doctors, however it is a fundamental strategic initiative.	Enterprise process improvement and planning scope
COO	We have a physician who is a champion for evidence based medicine program and [Ms. X] is also the administrative person who works with [the physician], and they have begun this process with several departmental experts looking at several areas. [...] Our motto there is to try to understand what elements of lean thinking can apply to the various value streams in healthcare that we have. So	Holistic performance measurement *Different people responsible for different initiatives,*

	again we have [Quality and Safety Director] is leading that effort	*and don't talk with each other*
Chief of Strategy	When they measure things at the health plan, they measure things "whatever per thousand patients". When I came here our measurement systems aren't about patients at all. It is not about individual people. We don't measure patients. We measure encounters. We measure visits dmini outpatient clinics by department. We measure visits dmini emergency room. We have 36,000 visits dmini emergency room per year. I can't tell you that it is 36,000 people, dmin is 10,000 people, or dmin is 5,000 people. I am certain that we have some frequent flyers who over the course dmini year are here 10 times and we have other people who are here once or maybe once every three years, dminis point dminis we don't measure people. We measure use of our system.	Process enterprise measurement capability *Unable to measure at patient level, but rather system use level*
Chief of Strategy	We cannot easily break down the revenues from each of these two groups. 80% of patients come from [our State]. 10% come from [northern State] 5% come from other [adjacent States], and the other 5% from other parts of the country.	Process enterprise measurement capability *Actually they could, but the IT system doesn't do it for them*
Chief of Strategy	We track ED physician productivity by the number of encounters per FTE	Holistic performance measurement

Senior Leadership Organization View

Interviewee	**Interview quote(s)**	**Focused Coding**
CFO	The problem is that [Chair of ED], and others, only control what is inside their environment, so he can make that commitment and implement what he can in his environment, but the things that he doesn't control which are probably equally as many things as he does control, he may not be able to implement, if we don't influence it early. You put a new computer system in. You put a lot of time into change and support that process. You get the mission critical applications in place. Once that is done, you never seem to have the time to go back and add the bells and whistles, because now you are back to normal business and you don't have the time. I am forcing people back to make sure that they keep adding the bells and whistles over time, but it takes an extreme level of discipline to do that because it is extremely hard to find the time.	Local organizational climate and subculture
CFO	The thing that always worries me, from having been here for so long, is that it is so hard to get the commitment of the medical providers to change, that if we get too far down the path, even though we have the simulated models and the concepts designed, and agreement, the rubber hits the road in implementation, and we often find that we can't get there. Part of that is that we are not a top down organization. With 500 physicians it is a consensus building organization. So the CEO might say you know, in the planning process, "absolutely, we are going to do this, and we will make everybody do it, and what a great idea", and what it comes to the end, when the medical staff go "oh we don't really want to do that", the CEO goes "ohhh... okay" [CFO bursts out laughing] and then we have to live with it.	Local organizational climate and subculture Leadership acceptance by internal stakeholders
CFO	We have the means to show the variability of expenditure by procedure by physician... we have done a little bit of it, but what little	Enterprise cultural harmony

	we have done we are getting a lot of push back from the physicians, they don't want to be measured individually, they want to be measured as a group. It is amazing, once you are performing up here [makes a sign with the hand at high level] I say to them "I can't believe that you guys even want to let the ones who are down there be down there. Why should you be carrying those guys?". But they seem to be okay with it. [...] Leadership has to decide what it wants to do, to help communicate that to the staff physicians, and I don't think they are there. I don't think they are there. I still think the physician leadership still sides with the staff physicians. The administrators may want to provide more transparency, provide more information, try to get these guys to understand what their contribution is or isn't, and that there is opportunity to improve, but we don't have a physician leadership thinking that way. So there isn't a meeting of the minds between the two groups, and part of that is that we are doing well and so there is no sense of urgency.	*Non clinician admin on physicians* Enterprise history and culture *Senior leaders siding with physicians* *Undermines leverage of process enterprise measurement capability*
Chief of Strategy	Our finance people, our IT people, our supply chain people, they don't really understand how the delivery system works, and they work at [Hospital XYZ].	Enterprise cultural harmony
CFO	From a realistic perspective, politically it would be a hard sell here probably [to hold back on the new ED] because the CEO getting in and even long before the Board approving the project, told the whole department "you are getting a new ER". He was way ahead of the rest of us, and probably, I wish he hadn't gotten so far and so fast. I would love that most, if not all the time, decisions were made based with good sense and facts, but unfortunately politics don't lend themselves to that.	Enterprise cultural harmony *CEO attempting to reach out*
COO	[Hospital XYZ began] in the 1920s when all the large group practices were beginning to form like Mayo Clinic and Cleveland Clinic. Like those large practices they generally had their origins in surgical leaderships. [...] When [Hospital XYZ] moved out here part of the requirement was that we also include a primary care presence in the community. So as soon as we came here [Hospital XYZ] became a success. The state [made that requirement] as part of building a not for profit, we had to provide access, it couldn't just be for [Hospital XYZ] patients only. So we created an emergency room, that anyone could use as a public good, and that we began to have patients who wanted to get their primary care at [Hospital XYZ]. This [patient choice for primary care] didn't really change our model but we responded to it. So we added a significant a number of general internal medicine physicians, and they generated referrals to our specialist, and so we needed to hire more specialists, so we kept growing and growing, but our emphasis was always on diagnostic challenges and complicated complex care requiring highly skilled and specialized physicians, and that really is our model. [...] Our character is specialized care and not to be a community hospital. [...] We added primary care as a specialty when we moved out here but continued to maintain our reputation as a tertiary diagnostic center. [...] [Hospital XYZ] even as it moved forward in its origins was a multi specialty group practice, it really never was a single specialty group practice.	Enterprise history and culture

	[...] Physicians are salaried and while no one makes the same salary, basically they have the oversight of lay people who are not directly involved in the institution and was a public charity. And the governance model is the staff elect a board of governors, and the board of governors elect a chair, and the chair is a CEO, and chair will always be a physician. And the trustees allow the medical leadership, the board of governors and the CEO, to manage the affairs of [Hospital XYZ] with lay oversight. But it really is a physician led group practice, and the group practice decides what it needs to take care of the patients that it wants to take care of, and the hospital is an extension of the group practice, as opposed to all the other places in [city centre] where the hospital existed and individual physician practices developed to support the hospital.	
COO	Physicians are salaried and while no one makes the same salary, basically they have the oversight of lay people who are not directly involved in the institution and was a public charity.	Individual incentives
COO	Then [Hospital XYZ] hired a new CEO in 1999 as a result of the old one leaving, and he was here for about 6 months, and all of the sudden [Hospital XYZ] started losing money, and so then I became the COO in December of 1999	Enterprise history and culture *Hospital financial incentives*
COO	usually people feel that a large impediment for the change is the physician. At one level that is true because physicians are conservative, because I don't think you want to go wild on anybody without a lot of care and as much evidence as possible before they do something.	Enterprise history and culture *Resistance to change*
COO	In healthcare we say that this [his pen] is the most powerful technology in the world because the only person that can get anything done on a patient is a physician, a legal person who can write orders and change things. [...] the physician is directing the care or he is directing someone else to direct the care, whether it is in the hospital in terms of orders, whether it is working up a set of symptoms on a problem you have, or whatever you have	Enterprise history and culture *Power of the pen signing off*
Chief of Strategy	when we have these contractual arrangements with insurance companies, in general, not in every case, but it is very difficult to make money within health patient primary care practice. That is not how we at [Hospital XYZ] make money. We don't make money from our patient primary care. We have a lot of outpatient primary care, but we don't make money from it. We would make more money from specialty care. We make our money from procedures, surgeries	Enterprise history and culture
Chief of Strategy	Our doctors here are involved in deciding what the strategic priorities of the organization are going to be. In the community hospitals the CEO often times is the business person, and the doctors in the community who have used that workshop are constituencies that they need to keep happy but it is not the doctor's workshop.	Enterprise history and culture *Physicians decide strategic priorities*
Chief of Strategy	there is an internal motivation that we need to get the constant financial pressure, so that we need to do this in order to be able to create a margin and to be able to take care of more and more patients, do it efficiently, do it in a high quality way.	Enterprise history and culture *Hospital financial incentives*
COO	Average length of stay is 4.6 days, including solid organ transplantation, and no psych and no OB. One of the theories we have in terms of looking at the whole enterprise, is not just getting out of the ED, it is getting out of the hospital. One of the things that	Enterprise cultural harmony *Leadership aware*

	we have found is that there is a body of consultation and testing that is part of the ED workup before the patient gets to the floor, and what we have found is that if the patient needs a CAT scan while they are in the ED, through a care process map, or just being in the ED, getting that test done is basically the single build mode. We have great concern that if the goal is to get them on the floor quickly and then order those tests, that then they become in the large queue for the whole hospital with all the other patients that needs whatever and in the end the length of stay for that patient in the hospital is smaller. Having the patient doing those tests in the ED really saves us time on the LOS.	*that ED is being used to support inpatient and shorten LOS. But still, ED contribution not accounted for.*
Chief of Strategy	Most people only focus on today, or next month, or next quarter, or last quarter, we have done very well. The big challenge that I see for the re engineering work is that we don't have a burning platform in terms of organizational results. We grow every year, we attract more patients, we have more admissions, more surgeries, financially we have made more money in the last two years than ever before. From a bottom line perspective we are very successful. The platform that has embers in it, is that I don't think we can get people to buy in that in five years from now things are going to be really bad, I don't think people can look that far out. I think the burning platform we need to build is that how much stuff gets between them and doing their job.	Enterprise history and culture *No sense of urgency to change*
CFO	So there isn't a meeting of the minds between the two groups [i.e. administrators and physicians], and part of that is that we are doing well and so there is no sense of urgency.	Enterprise history and culture *No sense of urgency to change*
CFO	How many emergency rooms do we have today?	Enterprise history and culture *Unaware of ED size even though it is the same for the past 20 years*
Chief of Strategy	Even if we don't have a huge personal financial incentive, we have the incentive for the organization as a whole to be successful so that we have the capital to reinvest in new technology, new space, and so forth.	Individual incentives
Chief of Strategy	there is an internal motivation that we need to get the constant financial pressure, so that we need to do this in order to be able to create a margin and to be able to take care of more and more patients, do it efficiently, do it in a high quality way.	Enterprise history and culture *Hospital financial incentives*
Chief of Strategy	We have for years practiced team based medicine. And that manifests itself in a number of ways. The doctors go to the same cafeteria, they go to the same meetings, to the same committees, the paycheck has the same logo on it, and so they know each other, they work together, they consult with each other, the bigger the organization has gotten, the more challenging it is. [...] So people here view[Hospital XYZ]patients as[Hospital XYZ]patients, and not as doctor XYZ patient.	Individual incentives Enterprise history and culture
Chief of Strategy	People work by the hour, they do their time, and then go home. They are salaried and don't have the incentive to do more.	Individual incentives Enterprise cultural harmony

Senior Leadership Knowledge View

Interviewee	Interview quote(s)	Focused Coding
COO	For outcomes we use Evidence Based Medicine based on various disorders there are evidence now, a lot of it is more empirical now, in other words there is still an amount of art to evidence based medicine but over time there are enough studies that are published that indicate that certain behaviors are better with certain diagnostic or disease states in terms of treatment. [...] You start out with a generic view of evidence based medicine and then you apply your own experts to it. Modify it, and then you come up with what you believe is evidence based guideline on how to take care of certain things. And then you try to create order sets and behaviors and try to monitor how well people conform to those guidelines, and there are not either or, there are exceptions. So the metrics around that are basically deviations from evidence based guidelines and this is somewhat in its infancy. [...] There is a company out there that is part of hertz publications that is called Zynx, and they publish evidence based guidelines and are constantly monitoring the literature, and they have a collaborative workspace environment where groups can collaborate, modify, or change guidelines, and they have the ability to move you from what you should do to the evidence if you want to see why they are saying this is the right thing to do	Evidenced based medicine *Internal teams assess/adapt evidenced based medicine guidelines* *External provider of evidenced based medicine*
Chief of Strategy	Our finance people, our IT people, our supply chain people, they don't really understand how the delivery system works, and they work at [Hospital XYZ].	Knowledge transfer requirements
Chief of Strategy	We are never going to have pathways, standard orders, evidence based treatment recommendations, whatever you want to call it, for everything. It is not going to happen. There are always going to be either patients that are so complex. We don't just come as a diabetic, or come as a patient with hyper tension... you may be a diabetic that has hyper tension, high cholesterol, and maybe a bit of asthma, who knows! All the evidence based guidelines those are all about "this is what we do for diabetes", "this is what we do for asthma", "this is what we do for COPD". Those things are developed for diseases not for people. And then there is going to be cutting edge which will introduce variability to improve.	Evidence based medicine *limitations*
COO	We have a physician who is a champion for evidence based medicine program and [Ms. X] is also the administrative person who works with [the physician], and they have begun this process with several departmental experts looking at several areas.	Evidence based medicine *implementation*

Senior Leadership Information View

Interviewee	Interview quote(s)	Focused Coding
Chief of Strategy	We cannot easily break down the revenues from each of these two groups. 80% of patients come from [our State]. 10% come from [northern State] 5% come from other [adjacent States], and the other 5% from other parts of the country.	Business intelligence system *Process enterprise measurement capability Actually they could, but the IT system doesn't do it for them*

d. Inpatient Service Units

Inpatient Service Units External / Policy View

Interviewee	Interview Excerpt	Focused Coding
7C Charge Nurse	I can't simply discharge the patient from the bed to a waiting area. The other thing that comes in the way is legality. Technically what you would have to do is to discharge them from the unit and release responsibility of them being a patient anymore. There are some patients who are literally going home because they don't need rehab because of their age. I mean they can't sit in a waiting area for 3 hours after they have had their knee replaced 3 days ago. Those patients should stay in the bed. The patients are really sick these days, it isn't like the old days where they were ready to go home 2 days before being discharged. [chuckle]	Regulatory requirements and oversight
7C Charge Nurse	We have an orthopedics survey sheet [paper] we have to indicate on the day of discharge each day if there is any orthopedic discharge we have to write down their name, what time they left, and if they left late why did they leave late? Was it because they didn't get a bed late, I mean from rehab only calling until late [in the day].	Provider referral influence/pressure
5C Charge Nurse	Our sheet isn't placed in any system. It is a legal part of the chart, we have a bed side chart that we keep it in. We have two charts. We have the standard chart and then we have the bedside chart that we keep the vital signs and admit sheets in, and that is just based on convenience.	Regulatory requirements and oversight
5C Charge Nurse	We try to keep a 4 to 5 patient ratio of staff to patient.	Regulatory requirements and oversight
5W Charge Nurse	the ED will send a consult to our floor, and ask to give that report to a nurse who will be receiving the patient. If the nurse can't take it within those 15 minutes, then the charge nurse will try to take the report [from the ED] so that the flow can keep moving. The report [from ED to 5 West] is a handoff requirement by the Joint Commission and the state department of public health.	Regulatory requirements and oversight

Inpatient Service Units Strategy View

Interviewee	Interview Excerpt	Focused Coding
Cardiology fellow	Increasing capacity up here also increases the work that prevents us from getting down there [to the ED] in a timely manner too. [...] Another bottleneck is our holding area which wasn't designed with enough beds for the number of procedures that we are doing [in the ORs]. We have 5 [cardiology] procedure rooms and we have 7 holding area beds, and we often have a patient in the OR and the patient that needs to go next [is held in the holding bay], or the patient before, and we only have 7 beds. The best situation is where someone comes from here [the cardiology 5 West floor], goes to the holding area, has the procedure, and then goes back to their original room. Sometimes patients don't have a bed yet, they come to the holding area, say they are outpatients or they are a direct transfer, get a procedure, and no beds have been found yet during the procedure, and they have to go back to the holding area, and what that does is that the next patient can't come into the procedure room.	Enterprise transformation strategic scope
Cardiology fellow	The holding area because they are not technically in the hospital. That patient being in the holding area is creating an inability for those 5	Enterprise strategy

	cath labs to function, so you have got to get that patient out.	
Cardiology fellow	I think that reflects our business model of establishing a lot of referral base.	Enterprise strategy
5W Charge Nurse	This is a very aggressive service line. Which is probably the premiere role model for the institution in terms of efficiency, volume, outcomes, length of stay, you name it... this is a 36 bed unit that on an average day turns over probably 40% to 50% of the patients on any given day. So 56 patients on a given day could come through this unit in terms of workload of the physicians.	Enterprise strategy
6S	Another bottleneck in the ER... we spent a zillion dollars... the idea was to improve the ER flow but I think it is a silly idea. So what they have done is that they have now increased the volume inside the hospital but you still have a very limited access point, it is a small hole that people still have to squeeze through to get in. So once you have filled up these beds, which you do, there is like a week long back sucking these inpatients in it, but once they are in there because volume is full you are back to the same old bottleneck and do nothing different than the ER by adding more beds. We are seeing overall patients but there is no change in flow to the ER. Patients are still waiting to go upstairs and we are also slowing down our outpatient ED patients. [...] If you can get the power guy, [COO], to actually see really how the whole system is functioning. Give these guys a real big picture overview which I don't think they have.	Enterprise transformation strategic scope

Inpatient Service Units Service View

Interviewee	Interview Excerpt	Focused Coding
7C Charge Nurse	Orthopedics and neurosurgery let their patients know when they come in, from our standpoint, the type of elective surgery you are having done, indicates you would be going home in the next day, a 24 hour stay, plan on being out of the hospital at 10 o'clock in the morning, make arrangements, have someone there, and you are going to be out of here. They have done this the past year and it improved the flow significantly.	Extended enterprise management Service architecture management
7C Charge Nurse	Orthopedics is also doing... they are working on a system that their patient, they let them know ahead of time, you are having a joint replacement in 3 days, barring no complications, you will be discharged from the hospital and you have to be out by 10 o'clock in the morning. We will have all the paper work ready, we will have the visiting nurse set up for you, be prepared to go. This is doing really well.	Extended enterprise management Service architecture management
7C Charge Nurse	Over the course of the week probably a third [of my patients come from the ED]. Because I would, during the week I would say 25% from Mondays to Fridays, overall if you want to look at it from 11 to 7 and over the weekend, that would go to a third [33%]. 75% of admissions on the weekend are from the ER because the clinics are closed. All the orthopedics that come in [during the weekend] are through the ER [as] it is not a scheduled surgery done.	Extended enterprise management
7C Charge Nurse	if we don't take the patients out of the recovery room, and they don't get to my floor, then it gets backed up in the OR and they have actually had to stop the OR, because the PACU didn't have a slot for that patient that was done. The PACU was waiting to send us a patient.	Service architecture awareness/appreciation
7C Charge	Once you discharge that patient in the system it automatically gets	Service architecture

Nurse	kicked into the house keeping pager to clean the patient's room. It is all done by time frame. If I get my bed clean before 7 East got it clean is based on time. If my patient is discharged in the computer at 2.15 in the afternoon, and theirs was discharged at 2.30, mine should be done first. If admitting knows that recovery room needs to get 3 patients within an hour, and they know that 3 of those patients are booked on our beds, they will put a stat request in for house keeping to get those beds clean for us. They call it priority cleaning. When the house keeper finishes cleaning the room they will call, and basically it is an entry system that they have to put in what room they cleaned. Last night PACU was waiting for 2 hours to get our bed because it wasn't clean. But house keeper were so busy trying to take care of other floors, that finally PACU phoned up admitting, and admitting had to put it in as a stat, and "go, we really need it done". I don't know that house keeping have a grasp as to what implication they have... I still can't get over it... it is just mind blowing. The house keeper was in the middle of cleaning that room, she knew that she had to be in a meeting at 9 o'clock, she literally stopped cleaning the room in the middle of it, left it to go to her meeting and then came back and finished it. Now, it would have probably taken 10 minutes to finish it and she could have called her boss saying "I'll be there in 10 minutes". All of the sudden I was like "where did she go?". I think part of that is language barrier... or they don't understand the implications.	awareness/appreciation Service architecture management *housekeeping*
5C Charge Nurse	The computer system is such that when the patient transfer is signaled in meditech [i.e. the patient is now in a different room], a beeper message is sent to house keeping to clean the CCU room. That bed cannot be reoccupied until it goes back into clean mode. Now that requires, once the house keeper physically cleans the room, to go in through the telephone line, to call in the room as clean. She could do the cleaning instantaneously, or she could take half an hour, so there is great potential for inefficiency right there, because it is very much dependent on the person that is on that [house keeper] beeper. [...] In the scenario of patients coding in there, I would be moving the patient myself to the other floor, and actually nurses that are here would end up cleaning that room, and they would do that as fast as they could, knowing that the cath lab is going to push that patient from above. The minute I cleared these doors they are calling them say "bring him!" and they are doing whatever they can to clean that room and get it ready. It sort of bypasses really house keeping.	Service architecture awareness/appreciation Service architecture management *housekeeping*
7C Charge Nurse	I find the beds on this shift because I know for a fact after knowing how many beds I have left, and when I go downstairs to what they call "bed board", two times a day, you pretty much get an overview from the supervisor in admitting at that point, "you know what, recovery room have 17 patients that are awaiting to place, 7 of them are yours".	Service architecture management *Flow information transparency and timeliness*
7C Charge Nurse	The doctors in the emergency room would know ahead of time if we [at 7 Central] are on diverge, if we don't have any beds. The doctors that are in the emergency room all day long, they know our bed availability ahead of time. We even have a resident on his own call up to us from the ER and they go "do you guys have any beds up there? I have a patient down here that needs to be admitted".	Service architecture management *Flow information transparency and timeliness*
7C Charge Nurse	It is easier for us if the patients go to their respective floor and that a large percentage of each type of patient are all in one unit.	Service architecture management

5C Charge Nurse	Actual travel time with the elevator would take 15 minutes. The elevators are not strategically placed. For the emergency room to bring a patient up here they are on the west part of the building, and depending on who brings them up and how they elect to come, they can come up the west elevators, but they are at the furthest part of the building, so they would have to come across the hall of the west in order to come through our doors here, and they have to pass through 5 West, the patient area, to get here. If they don't want to pass a patient area they would come all the way to the west wing to the central elevators which is the back corridor. The difference is not travel time, but that they are in a separate corridor from the main public, and they wouldn't have to go through the patient area.	Service sustainability (patient experience) *Enterprise history and culture (physical layout)*
5C Charge Nurse	This morning when we rounded the physicians decided that based on the patient's condition he could be transferred, so we called admitting this morning and said "we need a 5west tele bed for this gentlemen". She told us "we don't have any beds at this moment". Now a bed has become available, she knows that because she has all the registry of the hospital, that bed is available because it is empty and it is clean, so she calls us, our unit secretary tells the nurse who has the patient that the bed is available.	Service architecture management *CCU also unable to admit to 5W. Adjustment with bed board*
Cardiology fellow	Another bottleneck is our holding area which wasn't designed with enough beds for the number of procedures that we are doing [in the ORs]. We have 5 [cardiology] procedure rooms and we have 7 holding area beds, and we often have a patient in the OR and the patient that needs to go next [is held in the holding bay], or the patient before, and we only have 7 beds. The best situation is where someone comes from here [the cardiology 5 West floor], goes to the holding area, has the procedure, and then goes back to their original room. Sometimes patients don't have a bed yet, they come to the holding area, say they are outpatients or they are a direct transfer, get a procedure, and no beds have been found yet during the procedure, and they have to go back to the holding area, and what that does is that the next patient can't come into the procedure room.	Service architecture management
Cardiology fellow	The holding area [is given priority over an ED patient] because they are not technically in the hospital. That patient being in the holding area is creating an inability for those 5 cath labs to function, so you have got to get that patient out.	Service sustainability (patient experience)
Cardiology fellow	Something that overrides all of this is the bed crunch. The ER is so busy. We are at 98% capacity [in cardiology] that even if someone wrote orders downstairs [in the ED] they would still be there for 6 hours until someone up here gets to go home. So that kind of makes other things mute.	Service sustainability (patient experience)
Cardiology fellow	In the afternoon when the house staff are open to take admissions you would hope that that gives another layer for someone to get down there to evaluate the patient. They get several admissions at the same time. They order them as to how sick they are. Number three on the list may not be seen for at least three or four hours, sometimes longer, depending on how sick the first two are. And they are in the ER the whole time, they are tying up beds down there. So the house staff goes through patients sequentially because you can only really go through one patient at a time. [...] In the morning patients come in through private services. On the cardiology side we don't have house staff working with us to admit patients. The fellows run the consult service, do the admissions for the attendings, or attendings have to do it themselves.	Service sustainability (patient experience) Service architecture management *No house staff in the morning to help in 5W admissions*

Cardiology fellow	The hang up may be that once admitted, to get paper work done, to get them to be seen, and it has to be done by the admitting doctor too so that takes some time. We go downstairs, we do our own evaluation, and rarely do we say "no this patient doesn't have to come in". We have to do our own evaluation, and write orders, make some phone calls and all that. I think to do that safely and appropriately would take 1 hour. From a cardiology fellow standpoint we also get delayed because we are doing consults on the floors too, and that sometimes delays things. Then assuming there is a bed, then the patient can get up [to cardiology from the ED] in an hour or an hour and a half [after the admit request was triggered by the ED]. Probably on average that doesn't happen.	Service architecture management
5W Charge Nurse	So they all [in admissions department] try to keep specific patient populations in the floors because the nurses become much more skilled in certain types of nursing, so if you keep the patients specific to a floor they are going to a floor where the nurses are probably more skilled in that type of nursing.	Service architecture management *Keeping similar patients in same units*
5W Charge Nurse	I think there is more teamwork amongst the nursing department than between the nurses and physicians per se. It is kind of physician dependent. There is a lot of teamwork between the mid levels and the nurses, but not necessarily the attendings as much. The attendings spend a lot less time in the units. We have teamwork between the interns, and residents, and the nursing staff. However, I think we have a lot of more opportunity for improvement. I think I would like to see more formalized times to meet with physicians. They seem to think for some reason that [such meetings] would be difficult to coordinate, that it may not work, but it could work well... that could be a huge opportunity for improvement... which means that nurses, and the physicians, and coordination of care, and ultimately the patients because if we can meet say at 9 o'clock in the lounge and go through all the patients we could all be on the same page. The patients could know what is going on today. We would know what patients would be going home. We would know potentially how many beds we can admit to. Whereas now the physicians don't necessarily communicate all that well with us, so it can be 3 o'clock in the afternoon and the physicians can come by and discharge 4 patients that we had no idea were going home. And that is problematic for the patient as well, because when they find out, they have to arrange for transportation and it might be that they can't get a ride home at that time of the day. [...] if we knew ahead of time that we were going to have those 4 discharges, we may be able to take beds for patients that were later in the day for the cath lab, and given them to emergency room patients.	Service architecture management Extended enterprise management
5W Senior Nurse	I could get started, at least being aware of what is coming, I could start my paperwork... the paperwork when I do a new admission... the paperwork! [grunts] I feel like I am taken from my bedside care which is why I became a nurse. I feel like I see less of the patient and more of the paperwork. So why am I repeating the same thing that somebody has done 3,4,5,6 times, when I could be doing spend time at the bed time with the patient. I could pick it up in the process of the admission.	Service sustainability (patient experience) Service architecture awareness *Nurses unaware of the pipeline*
5W Senior Nurse	Every time the patient comes back he starts from the beginning all over again. My father now has 4 doctors. He has leukemia so he has an oncologist. He is a diabetic so he has an endocrinologist. He has a heart condition so he has a cardiologist. And he has severe arthritis so he has rheumatoid arthritis doctor. So when something happens with	Service continuity (patient care) Extended enterprise management

	one of the specialties of his healthcare he would like to have all his doctors know about it, so that when he comes back he says "oh you didn't know I had a heart attack 3 months ago and was in the hospital?!!!". So it would be nice if we had a central database that could flag to all the doctors an update on a patient. The only person that gets notified when a patient is in the hospital for any reason is the [patient's] PCP. Now, they receive that electronically, but we don't know that they actually receive them. It doesn't work. I emailed the PCP Cardiologist because I know him because I work here, and I also notified the rheumatologist because there were issues with the meds that he was taking that they felt was causing his problem, I just emailed them myself. We called a family meeting... I orchestrated it, the system didn't orchestrate it. I had all 4 physicians sit at the same table and no information had to be repeated and joint decisions could be made. [note: a senior nurse was overhearing the conversation and acknowledged this was true] I see the frustration on patient nurse level where there will be frustrated family members "don't they know what the right hand is doing, when the left hand is getting information about?". It is almost like it is too big. I think communication is a major problem.	
5W Charge Nurse	the cath lab might have a busy schedule so they may up front say that "we already have 12 admissions for you today", and then the emergency room is often busy but patients that need to come up to a telemetry floor, so usually first we try and book the cath lab and we do that because there is nowhere else those patients can go, so we sort of have a conversation with them in the morning and ask them how many beds do you think you will need and we try to obviously keep in mind throughout the day that the cath lab has a very busy schedule today, so whatever else you try to fit in with patients that may be in clinic at doctors appointments that they decide need to be admitted but patients in the emergency room... but at least in the emergency room they are on a stretcher and they can keep them there if they need to, but if they are in the cath lab and they are done, they need to come to a bed.	Service architecture management *Priority given to cathlab, then clinics, and then ED*

Inpatient Service Units Process View

Interviewee	Interview Excerpt	Focused Coding
6S Hospitalist	the big picture thinking is sometimes not even remotely there. I have been siting on this EMR committee for a while, and giving advice on how to do things, and somehow it came out that there is no big picture plan, they eventually are going to put together 5 or 6 separate systems and try and knock them together somehow. Everybody has this little microscopic little view of things and they are not seeing the big picture. They are totally missing it.	Enterprise process improvement and planning scope
7C Charge Nurse	We have an orthopedics survey sheet [paper] we have to indicate on the day of discharge each day if there is any orthopedic discharge we have to write down their name, what time they left, and if they left late why did they leave late? Was it because they didn't get a bed late, I mean from rehab only calling until late [in the day].	Service unit process optimization behavior Process enterprise measurement capability
7C Charge Nurse	We did a little survey for a while on [ED nurse reports], what time we get all this information from the emergency room and how long it	Service unit process optimization

	takes for a patient come up here. If it is an orthopedic, if it is a trauma patient, if it is a neurosurgery patient, then I tell you they usually are up, from the time we get report they are up within 15 minutes	behavior Process enterprise measurement capability
7C Charge Nurse	After the doctor [in 7Central] has written the discharge order and then the patient either gets transferred to a another facility, whether it be rehab, or skilled care, or home, or home with visiting nurses... or another [hospital] facility, that happens, they need different type of care. The time that they leave, the unit coordinator, or the nurse, will go into the computer and discharge them. If they put it in the system within 15 minutes of the patient leaving it isn't a bad time frame. On my shift, when I am here, [chuckle], I am really bad at it, I am like "get it done! the sooner we get a patient up here, the sooner we get the room clean, the sooner our work is going to be done", you are not avoiding the inevitable.	Service unit process optimization behavior *Service architecture awareness/appreciation*
5W Charge Nurse	It is more the nurse letting the unit coordinator know [chuckle] the patient went. Sometimes the nurses will hold out... so that they don't have to get another admission. That is what I'll say "you're holding onto the bed". I am not saying that they hold out a long time, like hours you don't know about it, but sometimes you don't always know.	Service unit process optimization behavior *Service architecture awareness/appreciation*
5W Charge Nurse	They [in admitting] could page us and we might not, we might say "oh yeah yeah, okay fine" continue with other stuff, no I don't want to admit another patient yet or whatever! [chuckles] I could be busy with something else. And then usually we'll get a call from admitting [chuckle] "you need to assign that bed!", you know, whatever.	Service unit process optimization behavior *Service architecture awareness/appreciation*
5C Charge Nurse	We also have a patient hold up because we can't move a patient out of CCU to another floor. To put it quite simply is that what very often happens in this area... we have 8 patients so say after rounds are over they say 5 patients can go out, so in everybody's mind there is a potential for 5 beds, notice that I said "POTENTIAL"! They are not gone! [chuckle] there is just potential... so the CCU team know that there is a potential because it is their patient, so they know that they can move out, and they say "oh I have a patient in the cath lab and I want to bring over". Now they know that these beds aren't empty, or maybe they are maybe they aren't. We can wait for the system to work because they have a waiting area in the cath lab. But if somebody codes in the cath lab, now it has become urgent, that patient has got to come out of that area to be admitted here, and so that pushes the system, that means I have a patient, I know I can take a patient out [from CCU] in 10 minutes time, so I am calling admitting to say "where can I put the patient?", and they already know that a code is going on.	Service unit process optimization behavior *Cardiology assumes patients can move out of 5C upon discharge*
5W Charge Nurse	We have an electronic bed entry system, so right now every morning somebody in hospital admissions generates a list of the schedule of admissions for the day, and that includes the list of patients that are having surgical procedures. The majority of those patients don't come to my floor. My floor is a little more difficult to manage. Sometimes it is very even in terms of the expected discharges and the admissions, sometimes there are many more admissions that need placement than there are discharges today, or at least discharges that you know about.	Prevalence of undesirable standards
5W Charge	They have a big plasma flatscreen down in the hospital admissions	Service unit process

Nurse	department which displays each floor and it displays all room numbers, it tells them if the room is vacant or occupied, it tells them if the room is dirty or clean, so when we discharge a patient it sends a page to housekeepers to say that that room needs to be cleaned. So as soon as you discharge the patient electronically, housekeeping gets a page saying that they need to go clean that room. Admitting doesn't necessarily wait until the room is clean, ideally that was supposed to be the case, but there is always such a bed crunch that as soon as they see that you have discharged a patient they flash the patient up. [...] Part of that is because nurses might want to get some rest. Also, they might want to game the system because they know that admitting will immediately flash them a patient without even waiting for the room to get clean. Therefore they wait until they have two rooms so that cleaning takes care of both at the same time. Or they try to flag down cleaning through other channels in order to make sure that the room is clean.	optimization behavior *Bed board and 5W nurses gaming the system*
7C Charge Nurse	Last night PACU was waiting for 2 hours to get our bed because it wasn't clean. But house keeper were so busy trying to take care of other floors, that finally PACU phoned up admitting, and admitting had to put it in as a stat, and "go, we really need it done". I don't know that house keeping have a grasp as to what implication they have... I still can't get over it... it is just mind blowing.	Degree of process standardization and transparency
7C Charge Nurse	The walking time from the ER to here is 5 to 7 minutes including the ER ride. But you are going find there is a big difference in time frame from getting a medical patient up here, and getting an orthopedic, because what happens, you've got a couple of residents that are just medical residents that are assigned that night to do admissions throughout the hospital. These are patients that don't have a private attending doctor. Any medical patient that comes through the emergency room, these two doctors have to take care of them. We are talking chest pain, we are talking pneumonia, we are talking any medical condition, so... they have a lot of patients to see. I think their workup takes longer because it is not as specific as looking at a fracture, sometimes they need to do more diagnostic tests, figure out what type of care they need, and then, you only have got these two doctors that have to write all the orders and the HAPs on these patients. So, if you only have got two doctors... we have actually booked a medical patient in the system and not got a call from the nurse until 1 to 2 hours after that with report.	Degree of core process complexity and flexibility
6S Hospitalist	The [ER] people who feel that it is essentially their job to decide admit or discharge and then pass it on to us, feel that that accelerates the movement of someone on the floor because they called us sooner, so that we can get their sooner, so that we can get them out of the ER sooner. But it is just the converse because we go down there and we find that treatments that need to be done now haven't started yet, you need more acute evaluation, etc. It actually slows everything down contrary to what their belief is. It is a touchy subject because you don't want to be a doctor and have someone tell you that your work sucks. [...] They will have sent for lab work and they have not gotten it back and yet they will have already called me to come down to pick up the patient. [...] Sometimes the evaluation done in the ER is quite superficial. So the	Service unit process optimization behavior *Enterprise cultural harmony*

	sign out that we get is either innacurate or wrong. But if you ask the ER they will say otherwise. The evaluation accuracy is person to person dependent in terms of the effort they put in. Some people's philosophy is that they try to do as thorough workup as they possibly can. Others view the ER's role as essentially a triage center, and so beyond the decision admit or discharge, it is not their problem. So it is physician dependent.	
6S Hospitalist	A specific set of information should be required of an ER physician before signing out to another physician. For instance, when the ER physician signs out to myself [an inpatient hospitalist] he should be able to know a real diagnosis, I mean what the labs have shown, vital signs, etc, a strict criteria that should be met.	Degree of process standardization and transparency
5C Charge Nurse	The charge nurse then calls the nursing supervisor and lets her know that you have been contacted about a bed, and the nursing supervisor, I believe, is the one who talks to admitting... they change it several times. You know if there are problems that have arisen, they will change the system, and that is the latest revision [chuckle] [...] They keep changing things on us... as far as I know beds 1 through 6 are CCU beds, the last two beds here, 7 and 8 have been added to the MICU service.	Degree of process standardization and transparency *Inpatient nurse charged with contacting admissions to receive patient*
5W Senior Nurse	Up here [we asked for the patient information] and we then put it into a 4 page written note. No it is not computerized. We then do our 4 page called IPA Initial Patient Assessment. And then quite honestly as a staff nurse up here, when you get an admission one of the biggest things is time, and you are like... okay I am going to have to sit down and ask all these questions... and I start out apologizing [to the patient] and say "I am sorry, I know you have been asked all these questions, but now I am going to write it on my piece of paper. The ED wrote it on their piece of paper and put it in their computer. And the doctor may or may not have a copy". [...] On this floor we are fairly organized. On this floor we use a disposable piece of paper, it gets thrown away, but it is valuable for the time that the patient is here. On our unit we have such turnover, we have 50% of turnover on the floor, I don't have time to go back to this [patient medical] chart, so we write on our own 4 pager what was the chief complaint, what is their past medical history, what was done in the cath lab, what is the plan. We write this down so that we know where they come from, where they are at, and where they are going.	Service unit process optimization behavior Degree of process standardization and transparency
5W Charge Nurse	It impacts the flow everyday in the hospital. It seems like there is a lot of empty beds and no one has a flow problem or every department wants to send you patients,	Degree of process standardization and transparency

Inpatient Service Units Organization View

Interviewee	Interview Excerpt	Focused Coding
6S Hospitalist	People in the ER have to wait an exceptionally long period of time before they are even seen by the MD so this deteriorates the patient's health.	Enterprise cultural harmony
6S Hospitalist	The ER issue just frustrates the hell out of me. Just make it more efficient. Better philosophy.	Enterprise cultural harmony
6S Hospitalist	Their view [ER] is a limited. We work both in the ER because we are going down there picking up the patients that are in the ER, dealing with the evaluation issue and then bringing them up here. Whereas their view they don't see what happens up here. They really don't.	Enterprise cultural harmony

	They are very isolated as to what they see. They see first contact and that is it.	
6S Hospitalist	The people controlling the department I think often don't know what the hell our opinion is, they don't how it flows, they don't know what is going on. Really it is odd when you watch what happens. Like you are putting together an electronic medical record system, and the people responsible for putting together at baseline don't know anything about EMRs or about the patient flow. [...] If you can get the power guy, [COO], to actually see really how the whole system is functioning. Give these guys a real big picture overview which I don't think they have. [...] Hospital XYZ is a physician led facility. However the higher up you get in the structure, the farther away you get from actual patient care. So the people across the way [the freestanding leadership building disconnected from hospital] that are in the power structure, are basically sub specialists, and they are not the guys who are writing orders for labs, they have at the very least a fellow, and then a resident under that, and then an intern, and then a medical student. They are completely insulated from the trenches, which is what the hospitalists do. The guys up there are completely insulated.	Local organizational climate and subculture Leadership acceptance by internal stakeholders
6S Hospitalist	The [ER] people who feel that it is essentially their job to decide admit or discharge and then pass it on to us, feel that that accelerates the movement of someone on the floor because they called us sooner, so that we can get their sooner, so that we can get them out of the ER sooner. But it is just the converse because we go down there and we find that treatments that need to be done now haven't started yet, you need more acute evaluation, etc. It actually slows everything down contrary to what their belief is. It is a touchy subject because you don't want to be a doctor and have someone tell you that your work sucks. All of them are capable of doing their job correctly. It is that some ought to stop calling us to soon.	Local organizational climate and subculture
5C Charge Nurse	I think the biggest holdup between transporting the patient from the ER, once it is decided, and getting them here, is they need somebody to accompany the patient and it has to be professional people. Usually when they come up it is a nurse and an aid. It is always two people. They have to be monitored and obviously they have to be stable, and I think that sometimes that becomes the problem. Staff is stretched taking care of other other things, and they have to wait for a window when they can free themselves up to be actually able to bring the patient up. My impression is that from the time we get a report to the time that the patient arrives is that it is at least half an hour.	Enterprise cultural harmony
5W Charge Nurse	at least in the emergency room they are on a stretcher and they can keep them there if they need to, but if they are in the cath lab and they are done, they need to come to a bed.	Local organizational climate and subculture
5W Charge Nurse	I think there is more teamwork amongst the nursing department than between the nurses and physicians per se. It is kind of physician dependent. There is a lot of teamwork between the mid levels and the nurses, but not necessarily the attendings as much. The attendings spend a lot less time in the units. We have teamwork between the interns, and residents, and the nursing staff. However, I think we have a lot of more opportunity for improvement. I think I would like to see	Local organizational climate and subculture

	more formalized times to meet with physicians. They seem to think for some reason that [such meetings] would be difficult to coordinate, that it may not work, but it could work well... that could be a huge opportunity for improvement... which means that nurses, and the physicians, and coordination of care, and ultimately the patients because if we can meet say at 9 o'clock in the lounge and go through all the patients we could all be on the same page. The patients could know what is going on today. We would know what patients would be going home. We would know potentially how many beds we can admit to. Whereas now the physicians don't necessarily communicate all that well with us, so it can be 3 o'clock in the afternoon and the physicians can come by and discharge 4 patients that we had no idea were going home. And that is problematic for the patient as well, because when they find out, they have to arrange for transportation and it might be that they can't get a ride home at that time of the day. [...] if we knew ahead of time that we were going to have those 4 discharges, we may be able to take beds for patients that were later in the day for the cath lab, and given them to emergency room patients.	
5W Charge Nurse	the cath lab might have a busy schedule so they may up front say that "we already have 12 admissions for you today", and then the emergency room is often busy but patients that need to come up to a telemetry floor, so usually first we try and book the cath lab and we do that because there is nowhere else those patients can go, so we sort of have a conversation with them in the morning and ask them how many beds do you think you will need and we try to obviously keep in mind throughout the day that the cath lab has a very busy schedule today, so whatever else you try to fit in with patients that may be in clinic at doctors appointments that they decide need to be admitted but patients in the emergency room... but at least in the emergency room they are on a stretcher and they can keep them there if they need to, but if they are in the cath lab and they are done, they need to come to a bed.	Local organizational climate and subculture *Patient can't wait in an OR, but okay to wait on an ED stretcher*
7C Charge Nurse	Orthopedics and neurosurgery just got to the point that "you know what, we have got to do something because we want our patients to get on their floor".	Local organizational climate and subculture
5W Charge Nurse	Physician rounding is easier because patients are more grouped together [i.e. patients of the same service does belonging to the same attending], the nurse physician relationship is better because the physicians get to know all of the nurse's names and what type of care they deliver. For instance, if we get a colenrectal patient I think the surgeons are not necessarily fond of the nurses on 5 West because they don't perceive us to be surgical nurses, and that is because we are not, mostly 99.9% of our patients are medical, so by virtue of the fact that the nurses on 5 West very seldom take care of a surgical patient they are probably not as good at doing the things that surgical nurses are used to doing.	Local organizational climate and subculture *Team familiarity*
7C Charge Nurse	If you can't take report right now, then I am going to take report for you because we can't hold up things for 20 minutes until you are available to take report. If you have any questions then you can ask the nurse that took report. To speed up the process whether it be from the recovery room, or the ER, or the clinic, its been the responsibility now of the charge nurse, or a nurse who is free, to take report for that nurse [that is busy].	Local organizational climate and subculture
7C Charge	I find the beds on this shift because I know for a fact after knowing	Modes of

Nurse	how many beds I have left, and when I go downstairs to what they call "bed board", two times a day, you pretty much get an overview from the supervisor in admitting at that point, "you know what, recovery room have 17 patients that are awaiting to place, 7 of them are yours".	coordination: boundary spanner
7C Charge Nurse	I don't know that house keeping have a grasp as to what implication they have... I still can't get over it... it is just mind blowing.	Enterprise cultural harmony
7C Charge Nurse	Half the time it is so busy down there [in the ED] that the nurse giving report doesn't even give you time to ask questions. If we had the tsystem information prior to the nurse giving report it would make the handoff a lot more efficient.	Enterprise cultural harmony
5W Charge Nurse	We have a lot of new nurses so sometimes that makes the teamwork a little bit less just because when people are new they are very focused on getting their own job done, and they may not have as much time to help somebody else. I had a high vacancy rate last summer but I lost most of the employees internally [employees went elsewhere within Hospital XYZ]. Being a telemetry floor 5 West is often a stepping stone for nurses that want to go to a higher level of care like the intensive care or the emergency room. So it tends to generate a high vacancy rate just because of the kind of floor it is. So a high vacancy rate doesn't necessarily mean anything bad [at a service unit level], it is just a sign that people have moved on within the institution. [...] I think the nurse physician relationship is better [when specific patients are sent to specific floors with specific nurses] because the physicians know you, they know that you take care of that patient population all of the time, I think that it is far easier to call a physician that you know than one that you don't know... some of the new nurses on the floor are right out of school, their confidence level is not as high as other nurses who have a lot of experience who feel comfortable in calling a physician or asking questions. [...] If you take a new licensed nurse how would she be different from an experienced nurse? She may look for resources a lot more, I would expect for her to do mistakes doing a task that she has never done before, she would be looking to go to an educator on the unit, she would be looking to ask a more experienced nurse "oh I have never done this before, can you watch me do this?". On the other hand newly licensed nurses if they meet a problem, or have to call a physician about a question, they won't be as organized at obtaining the information that they need to give the physician, they won't be as confident in giving the physician the information they are giving, and they may not be as confident in answering physicians even then, they don't know whether it is right or wrong, because physicians aren't always right either and sometimes they might tell you something and you might not agree with it. An experienced nurse would be I think very willing to say "I don't think that is a good plan" or "I don't agree with that". [...] As the years go on I think that the turnover is bigger because of a lot of nurse burn out...	Local organizational climate and subculture *Psychological safety*

Inpatient Service Units Knowledge View

Interviewee	Interview Excerpt	Focused Coding
5W Charge	We have a lot of new nurses so sometimes that makes the teamwork a	Knowledge transfer

Nurse	little bit less just because when people are new they are very focused on getting their own job done, and they may not have as much time to help somebody else. I had a high vacancy rate last summer but I lost most of the employees internally [employees went elsewhere within Hospital XYZ]. Being a telemetry floor 5 West is often a stepping stone for nurses that want to go to a higher level of care like the intensive care or the emergency room. So it tends to generate a high vacancy rate just because of the kind of floor it is. So a high vacancy rate doesn't necessarily mean anything bad [at a service unit level], it is just a sign that people have moved on within the institution. [...] I think the nurse physician relationship is better [when specific patients are sent to specific floors with specific nurses] because the physicians know you, they know that you take care of that patient population all of the time, I think that it is far easier to call a physician that you know than one that you don't know... some of the new nurses on the floor are right out of school, their confidence level is not as high as other nurses who have a lot of experience who feel comfortable in calling a physician or asking questions. [...] If you take a new licensed nurse how would she be different from an experienced nurse? She may look for resources a lot more, I would expect for her to do mistakes doing a task that she has never done before, she would be looking to go to an educator on the unit, she would be looking to ask a more experienced nurse "oh I have never done this before, can you watch me do this?". On the other hand newly licensed nurses if they meet a problem, or have to call a physician about a question, they won't be as organized at obtaining the information that they need to give the physician, they won't be as confident in giving the physician the information they are giving, and they may not be as confident in answering physicians even then, they don't know whether it is right or wrong, because physicians aren't always right either and sometimes they might tell you something and you might not agree with it. An experienced nurse would be I think very willing to say "I don't think that is a good plan" or "I don't agree with that". [...] Most nurses tend to find the type of nursing that they like, and they navigate towards that type of floor. So it is better satisfaction for them to take care of the types of patients that they like taking care of.	requirements
5W Cardiologist Fellow	[ED Charge Nurse responsible for bed tracking says:] If he [Cardiologist Fellow] goes to evaluate the patient [in the ED] as opposed to house staff [i.e. medical residents] he would be much quicker at it because of his experience and his stance. There is no shot for house staff because they are on the learning curve. He is on the upper end of his learning curve because of his experience. So they are not equal arguments. X is going to see 3 patients in the same time that people with less experience will see 1 patient [in the ED]. [Cardiologist agreed] Having the intern doing the admissions slows down things but that is the only way for them to learn.	Knowledge transfer requirements
5W Senior Nurse	A lot of these papers that you write that transfer from unit to unit is not something that you are going to save, it gets lost, it is not part of the permanent record.	

6S Hospitalist	Pathways are a good idea. We have a lot of pathways here. You have different people rotating through on the inpatient service, people who don't always do it all the time, and when you don't do something all the time you are not necessarily as good as it. You don't remember what you should be doing. So I think that clinical pathways lead to better quality of care.	Evidenced based medicine

Inpatient Service Units Information View

Interviewee	Interview Excerpt	Focused Coding
5W Senior Nurse	Up here [we asked for the patient information] and we then put it into a 4 page written note. No it is not computerized. We then do our 4 page called IPA Initial Patient Assessment. And then quite honestly as a staff nurse up here, when you get an admission one of the biggest things is time, and you are like... okay I am going to have to sit down and ask all these questions... and I start out apologizing [to the patient] and say "I am sorry, I know you have been asked all these questions, but now I am going to write it on my piece of paper. The ED wrote it on their piece of paper and put it in their computer. And the doctor may or may not have a copy". [...] On this floor we are fairly organized. On this floor we use a disposable piece of paper, it gets thrown away, but it is valuable for the time that the patient is here. On our unit we have such turnover, we have 50% of turnover on the floor, I don't have time to go back to this [patient medical] chart, so we write on our own 4 pager what was the chief complaint, what is their past medical history, what was done in the cath lab, what is the plan. We write this down so that we know where they come from, where they are at, and where they are going.	Prevalence of paper information systems Information systems integration
5W Senior Nurse	I have been here 17 years, and one of my main issues is the repetitive questions over and over and over again. Ideally I would like to see an admission assessment start in the ED. All the demographic, why you are here, initial vital signs, your history, done once, and let that move along with the process to the floor, so that this nurse up here is not repeating... because down in the ED that patient has been asked by the initial assessment doctor, the nurse that received him, any consult physician that comes in to the room. They can be asked 2, 3, 4 times the same story, then guess what, they come up here and I am going to start again [chuckle], the admission doctor up here is going to start again [more chuckle]. There was one of our nurses who was admitted to the ED and sat next to a patient who refused to give further information about her meds. She said "you know what, I am not going to answer you any more. I have already given you this information. It is somewhere in this hospital. I am done repeating it. Please leave me alone". Patients are tired.	Information systems integration *Service sustainability (patient experience)*
5W Senior Nurse	I could get started, at least being aware of what is coming, I could start my paperwork... the paperwork when I do a new admission... the paperwork! [grunts] I feel like I am taken from my bedside care which is why I became a nurse. I feel like I see less of the patient and more of the paperwork. So why am I repeating the same thing that somebody has done 3,4,5,6 times, when I could be doing spend time at the bed time with the patient. I could pick it up in the process of the admission.	Prevalence of paper-based systems Information systems integration
5W Senior Nurse	Right now as it stands the T-System does not interface with any place beyond the ED. So what actually happens is hard copy of the	Information systems integration

	documentation should be produced and come up with the patient. I should be able to come along, long after the ED nurse is no longer involved, and go look at the printed file. We can't access the ED system from here. The file has to be printed locally in the ED	
5C Charge Nurse	When the patient arrives here we check to see that they are stable, we write it on a sheet [not on any system], and then our unit secretary would call whomever on that [attending's] team for the intern and the resident to come down and examine the patient for themselves to write the admitting orders. The time stamp of the patient arrival to our unit is generated by the admitting office, but that time may not be the correct time, it may be another hour for the patient to be moved from the ER. [...] Our sheet isn't placed in any system. It is a legal part of the chart, we have a bed side chart that we keep it in. We have two charts. We have the standard chart and then we have the bedside chart that we keep the vital signs and admit sheets in, and that is just based on convenience.	Prevalence of paper-based systems Data reliability
5W Senior Nurse	A lot of these papers that you write that transfer from unit to unit is not something that you are going to save, it gets lost, it is not part of the permanent record. [...] On this floor we are fairly organized. On this floor we use a disposable piece of paper, it gets thrown away, but it is valuable for the time that the patient is here. On our unit we have such turnover, we have 50% of turnover on the floor, I don't have time to go back to this [patient medical] chart, so we write on our own 4 pager what was the chief complaint, what is their past medical history, what was done in the cath lab, what is the plan. We write this down so that we know where they come from, where they are at, and where they are going.	Prevalence of paper-based systems Information systems integration
5W Senior Nurse	LCMC is where we do order entry for laboratory work, x-rays, cat scans, medicine tests, and that is where we get our results from. The bed tracking is done in a separate system.	Information systems integration
5W Charge Nurse	you can do it within the system, you can pull up all of the information on the patient, their name, their age, their physician, their electronic number, and you go ahead and you assign them and it sends a message down to hospital admissions "assigned joe jones to room x in 5 west"	Information systems integration *Inpatient EMR shared with ORs*
7C Charge Nurse	Half the time it is so busy down there [in the ED] that the nurse giving report doesn't even give you time to ask questions. If we had the tsystem information prior to the nurse giving report it would make the handoff a lot more efficient.	Information systems integration
5W Charge Nurse	And the unit coordinator inputs that [discharge] within 5 to 10 minutes. It is more the nurse letting the unit coordinator know [chuckle] the patient went. Sometimes the nurses will hold out... so that they don't have to get another admission. That is what I'll say "you're holding onto the bed". I am not saying that they hold out a long time, like hours you don't know about it, but sometimes you don't always know.	Data reliability
7C Charge Nurse	They [in the ER] don't always tell admissions if the patient needs to be near the desk. Sometimes they write it on the system in a field next to the patient name. They can say "needs to be near the desk", or "needs high traffic" [of nurse observation]. They don't always do.	Data reliability
7C Charge Nurse	We have an orthopedics survey sheet [paper] we have to indicate on the day of discharge each day if there is any orthopedic discharge we	Prevalence of paper systems

	have to write down their name, what time they left, and if they left late why did they leave late?	
7C Charge Nurse	With our computer system... if we could have one program that did everything... we have programs for everything... we have bed tracking, we have meditech, we have xtech to get discharge summaries and operative notes... xtech only runs up here, the ED has the tsystem... [...] Half the time it is so busy down there [in the ED] that the nurse giving report doesn't even give you time to ask questions. If we had the tsystem information prior to the nurse giving report it would make the handoff a lot more efficient. [...] Once I know I am getting an admission from the ER, I should be able to get into the tsystem, take the time to get into the system, read all I can about them, and then when the nurse calls [to give report] she can then either give anything that wasn't put in there, or I can ask her what I want to ask her. You are not spending all the time going over data already captured in the tsystem. [...] Once they have physicians' orders then the nurse calls to our unit to say that she wants to give report to the nurse. It is a nurse to nurse report system. This reporting lasts probably 5 minutes. The nurse to nurse report, a lot of the information we could get on the computer, but I think the nurse to nurse report, granted it is vital specifics in terms of their diagnosis in terms of their medical history, and their vital signs, but I think that a nurse to nurse report gives you that personalized... basically you're saying that "they are a little agitated" or "the family was with them"... it is information that isn't easily captured in the system.	Information systems integration
7C Charge Nurse	emergency room techs that will bring the patient up with whatever paperwork from the ER. Probably any typed or computer printout because we are not hooked up to the T-System. Whatever typed paper work they have, or paperwork with lab values, or x-rays results, all that comes up, you know whatever chart was started, comes up with the patient [...] All their [ED] paperwork is done in the computer. We haven't even done that up here! [chuckle] Eventually each floor will be able to access the information once they plug in the medical record number.	Information systems integration
7C Charge Nurse	I find the beds on this shift because I know for a fact after knowing how many beds I have left, and when I go downstairs to what they call "bed board", two times a day, you pretty much get an overview from the supervisor in admitting at that point, "you know what, recovery room have 17 patients that are awaiting to place, 7 of them are yours".	Information systems integration *Can't see admissions board*
6S Hospitalist	I have been sitting on this EMR committee for a while, and giving advice on how to do things, and somehow it came out that there is no big picture plan, they eventually are going to put together 5 or 6 separate systems and try and knock them together somehow. Everybody has this little microscopic little view of things and they are not seeing the big picture. They are totally missing it.	Information systems integration *Enterprise process improvement and planning scope*
5C Charge Nurse	In order to the ER to admit a patient into this unit, they have to speak with our charge nurse to know the bed availability.	Information systems integration
5C Charge	The ER physician doesn't literally call... very often what they do, is	Information systems

Nurse	that everybody has phones and beepers, there is a page system within the computer. They can text message them or they can page them. And then they can talk with them on the phone. So they are not literally phoning them. There is a list to say who would be the attendings that are accepting patients that day in the different disciplines, so he would know who is accepting.	integration

Appendix V: Hospital ABC Additional Resources

i. Sample Qualitative Data Excerpts

a. Main ORs

Main ORs External / Policy View

Interviewee	Interview quote(s)
Main ORs Surgeon 1	The other system is the more throughput you have the more bonus you get as part of a bonus system. There is no reason why you shouldn't [have it]. This is a foundation trust, you can do anything.
Main ORs Surgeon 1	A timeout is done in the theater… do I take part in it? No… that is the biggest waste of time there is and I'll tell you why… because if I don't know that patient and I haven't seen that patient, I don't know what operation I am doing, then I shouldn't be doing it. I strongly believe that. […]I do my own checklist in my head.
Main ORs Surgeon 1	[chuckles] Okay. Evidence based medicine is a great terminology and how much evidence based medicine do you practice. In theatres most of what I do tends to move towards evidence based so evidence based tells me that I shouldn't be putting drains in my operations after surgery… it doesn't make any difference… they are more painful… and that we shouldn't do them. Common sense tells me that if I have a pancreatic leak, I then have a drain, it is a major problem, and I have to then get a drain in place for containing it. Evidence based is formed on meta analysis not looking at all the work but just looking at drains in surgery overall. So do I take an overall picture and apply it to my specific condition, the answer is no. So I don't practice it in that situation. But… I do think about it.
Main ORs Anesthesiologist	Well consultant here think that you are basically an independent practitioner. So you are basically free to practice the way you think is reasonable. Having said that you are expected to know the NICE guidelines and [Hospital ABC] guidelines. So we have internal guidelines too. […] Continuously there is one or two audits that compare our efforts to the standards set by the guidelines. This audit is delegated to one of the consultant anesthesiologist.
Main ORs Surgeon 2	**[JF: How do you measure quality?]** [chuckles] That is an embarrassing question… in this department we just follow the NHS guidance based on some audit tool and mandatory meetings, like M&M, but overall we don't have quality assurance strategy within departments.
Main ORs Recovery Nurse	Legally we cannot handover operation instructions to a healthcare assistant, a non qualified staff, so it has to be a registered nurse. Surgeon post operative instructions have to be given to the registered nurse, and any drugs which the patient has had intra operatively as well as in post operatively, has to be handed over with doses.

Main ORs Strategy View

Interviewee	Interview quote(s)
Main ORs	"[Hospital ABC] serves the local community and it also has a tertiary center and

Surgeon 1	has developed very strong tertiary setup over the years."
Main ORs Surgeon 1	"the[procedure X], there are probably only a handful of surgeons in the country doing that at the moment, and we have pioneered it here."
Main ORs Surgeon 2	"One is service delivery at the highest level of care and safety for the community... that is clear... and especially in [this area] where we have a strong diversity population catchment. We have all levels of wealth... it is something absolutely special..."
Main ORs Surgeon 2	"we want to be a strong part of the Academic Medical Science Center and we don't want to be the little brother of the family of two other big institutions"
Main ORs Surgeon 2	"[a] strength of [Hospital ABC] is a strong commitment to training and we know that there are other universities in [this area] that are more prestigious and with better rank... however at[Hospital ABC] is to be a first choice not only for patients but as well as for students and for trainees in the future to choose [Hospital ABC] rather than another place to be trained on."

Main ORs Service View

Interviewee	Interview quote(s)
Main ORs Surgeon 1	"Quality of care is a patient experience through the whole procedure, where you have given to them what they think is an extremely good service, that they have been treated effectively and quickly, no more complications, and that the outcomes were good. As far as I think it is a patient based experience that is the number one priority"
Main ORs Surgeon 2	"Have you been at the wards here? If not you will see the cultural shock if you come from another country where you have individual rooms of just two patients per room... looks an organized corridor... a bit like a hotel... In the UK you will see the cultural shock because you have the open space... wards look old... it is really embarrassing... It is a historical choice... it is a building choice..."
Main ORs Matron	"The idea of a holding bay is that they hold a patient until surgery. In terms of patient comfort and dieting it pays not to leave them down here for a long time. They want to go to the toilet and we don't have a patient toilet [down here]. We don't have facilities for them to watch TV. Patients should be checked in and sent to a theatre [immediately] ideally."
Main ORs Matron	"We keep quite tight. We are pretty micro managed. As soon as the patient arrives the holding bay nurse rings the theatre and tells them that "the patient is here". If there is a major problem like there is no consent, or there isn't a high dependency unit bed, we go out and speak with the consultant. So there is a bit of micro managing because we don't want to lose 1.5 hours and get another patient in that slot."
Main ORs Anesthesiologist	"Due to holding bay the sending issue is no problem for us... so we can send for a little bit earlier than when we usually need the patient actually. This is a very helpful device"
Main ORs Surgeon 1	"It doesn't happen because the ward round doesn't happen until the morning, and you never know what comes in at night. Beds aren't specifically blocked... there are emergency beds and there are beds for everybody... you can't block them. You can't say that these 5 beds for laparoscopic surgery."
Main ORs Surgeon 1	"All our major cases cannot be started on time because we don't know if there is high dependency bay available"
Main ORs Recovery Nurse	"You know it would be lovely if you sat in recovery and see what we have to go through. Of course they know, but for some reason they are either doing

	drugs, or they have gone on their lunch, or it is just one qualified nurse on the ward… they can't come. […]We give them 20 minutes notice. And after 20 minutes we ring them again. We can wait up to 2 hours sometimes"
Main ORs Surgeon 1	"Then you try to have the juniors [doctors] but they don't start until 7.45."
Main ORs Surgeon 1	"they will send someone to their coffee break when they are changing patients around, and that for me is stupidity. When you are setup and in full flight of surgery you can send someone for a coffee break or a lunch break, so that you are in the case, you still got one runner [nurse fetching material], and you have one person to spare, and the other can go for the break. I have no objections to that. But when you are right in the middle of turning around I expect that turn around to be quick and I don't want anybody leaving… and that is not happening."
Main ORs Anesthesiologist	" the thing is if somebody makes a move… I had a list like that with 14 patients on it… I would run around and find theater space for those patients to go to because I don't want to stay here until 10 o'clock at night. So if you make people aware of that it always works… But there isn't much proactivity to making people aware, especially of empty theaters"" But! Look! [points at stacks of paper on Main ORs Coordinator's office]. [She] is absorbed in other business so she can't run around and she can't spot the slot."
Main ORs Anesthesiologist	**[JF: Once the procedure is nearing its end is there any communication with the recovery bay to let them know you are about to finish?]** "Yes… usually 10 minutes. That is the plan… but as usual there is human error and sometimes it is forgotten to call the recovery bay or it takes sometimes ages for patients to wake up for no apparent reason, so it takes you 50 minutes to recovery, then they will take another patient, then they would expect the second call which will not come because they are probably short of staff again."
Main ORs Recovery Nurse	**[JF: Do you feel that the theater staff give you enough warning?]** "Sometime they don't ring and they will bring the patient in apologetically. And then because we don't always have enough nurses, especially at the moment with staff on maternity leave and sick, it does disrupt the smooth running because I try to have one nurse to two patients. If theater brings a patient without notifying us it disrupts us and we have to find a workaround."
Main ORs Matron	On the day cancellations. Although we have significantly reduced them we still have about 9% […] the odd late cancellation and we are already fully staffed to conduct that case
Main ORs Matron	Patient not pre assessed. My understanding is that a lot of patients don't get pre assessed properly […]patients are not fit for surgery because they haven't been pre assessed or they have been pre assessed but no one bothered to look at the results […]they were preassessed and they were fine but now they have a cold, or because they had a glass of milk
Main ORs Matron	not worked up properly would be the most common reason for patient cancellations. […]Patient not consented
Main ORs Anesthesiologist	90% of the time patients are ready [when they arrive to the holding bay]. What sometimes we have to wait for indeed is surgical consent, which means discussion with the patient and late start for the list.
Main ORs Anesthesiologist	Quite a few times we wait for blood results. Sometimes they take up to 4 hours to get the results on the computer system, so if the blood is taken at 11 o'clock

	and the operation is scheduled for 10, we might run into trouble there.

Main ORs Process

Interviewee	Interview quote(s)
Main ORs Anesthesiologist	Due to holding bay the sending issue is no problem for us… so we can send for a little bit earlier than when we usually need the patient actually. This is a very helpful device
Main ORs Matron	And opening the tray and finding that half that what you need is not in it. Or going to the shelf and realizing it isn't there.
Main ORs Matron	We all know that surgeons lie… so we would look at surgery finish time and anesthesia time to determine real surgery time. Surgeons will say that a triple A will take only 3 hours, however when you would look at the data you would see that it actually takes 5.5 hours by the time you have the patient prepped, with the lines in, etc.
Main ORs Recovery Nurse	**[JF: Do recovery nurses check to see if the notes are available before they call the ward to pick up the patient?]** We should do, and I know that is a fault of ours, but sometimes we are so busy that we might dismiss it, and this always happens at the end of the day. Our workload in recovery is always multiplied towards the end of the day, the end of the elective sessions… you know more patients are coming out
Main ORs Matron	Everybody [anesthesiologist] has a different system to deal with patients. I like to see my patients before they go into procedure. I don't want any of my patients to be taken anywhere before I check them. Or before I see that my equipment is clean
Main ORs Anesthesiologist	Sometimes it happens that the patient is positioned in a certain way and the surgeon says "ha ha! Well done! But I want it like this today!" So you start over all over again. You wasted 10 minutes.
Main ORs Surgeon 1	"we send for the patient… often I will say send for the patient… finish the case… I finished the cholangiogram on a lap chole [laparoscopic cholecysectomy] and as soon as I have done that I know you can send for the patient because by the time I turn around, finish this, the next patient should be there in 15 minutes."
Main ORs Recovery Nurse	Sometime they don't ring and they will bring the patient in apologetically. […] If theater brings a patient without notifying us it disrupts us and we have to find a workaround.
Main ORs Recovery Nurse	then we wait for the operation notes from the surgeon. Half the time we have to go looking for them or we then find that the surgeon is gone and nothing has been written, and that is a big headache. And sometimes we get a ward nurse to get the patient and she will not take the patient without the notes, which we can understand. So the patient then ends up in recovery far longer than is necessary really.
Main ORs Surgeon 1	The juniors put the lists in, they talk to radiology and tell them that we need imaging… This all depends on the middle grade who basically tell the housemen what to do and they implement it…. They communicate with other teams. […]Last week there were two days that we did not have junior doctors! Because of the junior doctor hours we have a problem… […]I have weeks when I don't have anybody…
Main ORs Surgeon 1	I don't pre requisitely say to them this is what I will use, this, this, and this. For the bypasses of a bariatric cycle they should know, it is standardized like a

	factory. I have even drummed it into their heads… I use one eleven port… I use two twelve ports… three five ports… I use an ND GIA 45… I use six sixtures… it is precision all the way through, and at the beginning of the operation they set it up. That they know. But there is some stuff that is a bit variable and they don't know what I will use. But they will work at it. But if you put one weak link into that system and it will break down.
Main ORs Surgeon 2	the bed pressure… there is a bed free there so the patient goes there… There are some preferences, where some wards are a bit more colorectal or vascular but overall there is a big mix of patients in the ward and no communication between the wards or little communication with theatres.
Main ORs Surgeon 2	I don't rely on metrics on a day to day basis… it is more of post information… "this has happened" and we note down the step further action will be taken… it is far from a daily concern.
Main ORs Surgeon 2	overall we don't have quality assurance strategy within departments. I am sure that at the Trust level there are some tools… […]I think that this data possibly exists somewhere in some higher level… If I open the [Hospital ABC internal] website you will find nothing.
Main ORs Anesthesiologist	I personally have no major concerns except that sometimes midday we run out of capacity in recovery. Then you have two choices. You can either go to recovery even though they have no staff and just sit the patient there until somebody is vacant. Or you wait in theater. And the anesthesiologist throughout that time is waiting with the patient. […]There is always more space than there is staff [in recovery bay]… so if you want to go there you can, just to try to get the theater ready for the next one as soon as possible.
Main ORs Recovery Nurse	It is usually I don't have a nurse available, and I will say "okay you can come in but you will have to stay with the patient until there is a nurse available. The anesthesiologist is usually very happy to stay.

Main ORs Organization View

Interviewee	**Interview quote(s)**
Main ORs Surgeon 2	the office… you see we have a beautiful clinical corridor [he is being sarcastic as the corridor is old and nothing glamorous with cringe doors] and then just there [chuckles and points out through the window] you have a wonderful management corridor. I would [like to] see some group or small department manager, their office would be here [at the clinical side]. We never book meetings at the management offices… We could share offices! If you share an office you can meet every day and there is no feeling of distance.
Main ORs Surgeon 1	Last week there were two days that we did not have junior doctors! Because of the junior doctor hours we have a problem…
Main ORs Surgeon 1	Yes we do get through the work… particularly my team never quibble about work… which is very different from 7 years ago when I first started… If I said I have to finish a case at 3 o'clock they wouldn't send and I had to cancel the patient. And this now does not happen because if I say now that I want to finish the case it happens
Main ORs Surgeon 1	this is unusual and part of that is the factor of achievement over the years… there is so few little factors that stop me from carrying on… rarely one of the older anesthesiologists might cancel… but I tend not to face that problem often. I don't make excessive demands… if I think a case will take longer and it is the end of the day already we won't do it. That has been one of the positive things over the years… the willingness to complete whatever it is on

	the list. I have built that space [that culture] with that theatre… the team and the space… so we can make it work.
Main ORs Surgeon 1	"Let me tell you something… I do laparoscopic, obesity, and general surgery… When you have one person from the 3 element team that does not know, that is the weak link, and I have one of them every week that I don't know"
Main ORs Anesthesiologist	"For pediatric and orthopedic service we have quite good team building because the staff is quite stable. Everybody knows the concepts that are run in this theatre.
Main ORs Surgeon 2	"here at [Hospital ABC] there are dedicated teams, which means that the same surgeon team will have nearly on a regular basis the same theatre, the same staff, the same team, and when I say team, I say even from the holding bay, where the first type of attention comes, it doesn't change. It is a critical strength in terms of efficiency because people know each other, communication, respect, … […] Though checklists and processes are safe that does not replace experience and pleasure to work together
Main ORs Surgeon 1	In the past I even tried to start and sending at 7 o'clock but that did not go anywhere… the patient is stuck on the ward…
Main ORs Surgeon 2	**"[JF: So how is it [the organization] laid out now?]** Well if I detail it I don't even know! What I know is that I am working in the department of Urology which is part of the… very strange… surgical and critical care… though it is surgical, there is another department with surgery with female and pediatric… I don't know the name exactly… and there is another that is liver surgery… So even our department within care group… surgeries in different care groups… my feeling is that it should not."
Main ORs Recovery Area	You know it would be lovely if you sat in recovery and see what we have to go through. Of course they know, but for some reason they are either doing drugs, or they have gone on their lunch, or it is just one qualified nurse on the ward… they can't come. […] We give them 20 minutes notice. And after 20 minutes we ring them again. We can wait up to 2 hours sometimes
Main ORs Recovery Area	**[JF: Do recovery nurses check to see if the notes are available before they call the ward to pick up the patient?]** We should do, and I know that is a fault of ours, but sometimes we are so busy that we might dismiss it, and this always happens at the end of the day. Our workload in recovery is always multiplied towards the end of the day, the end of the elective sessions… you know more patients are coming out.
Main ORs Matron	Also, getting the CSSD instruments without delay. Because they [nurses] have already enough frustrations in the day without having to constantly decontaminate and fresh sterilize equipment because they don't have enough.
Main ORs Surgeon 1	The patient is stuck on the ward… and you are trying to get these things to happen.
Main ORs Surgeon 1	For a surgeon theatres are extremely important. Main theatres have a wide range of sub specialties and you have a wide range of individuals that each of which have their own niches in developing tertiary practices. You'll see surgeons that are doing some new hip replacement, or some new something else… so everybody is developing a tertiary center as well as serving the local community. And that is difficult for theatres
Main ORs Surgeon 1	Currently I ask the anesthesiologist can we call for the next patient? The anesthesiologist will say yes we can call for the next patient, so the anesthesiologist helper will ask the sister, and the sister will say that she will

	call somebody, and that is where the holdup is, and they never call for the patient. [...] My personal view is that you [consultant] should direct the intercom link to the recovery staff or holding bay, you press the buzzer, "holding bay call for the patient". Get rid of all the nursing staff etc. Straight to holding bay. Get rid of everybody in the system.
Main ORs Surgeon 1	"One of the thing that drives me up the wall is... lets say I am changing cases... I do a case... we send for the patient... often I will say send for the patient... finish the case... I finished the cholangiogram on a lap chole [laparoscopic cholecysectomy] and as soon as I have done that I know you can send for the patient because by the time I turn around, finish this, the next patient should be there in 15 minutes. What happens? Depends how the staff are feeling. If they are feeling sort of a bit tired they will slow down and they won't quite send. The whole thing slows down because the faster they work the less break they get. They don't get a break. They have to clear the theater. Wash the theater. It is the same 3 staff. Clean the theater, get the next patient ready, etc. There is not enough staff to do that."
Main ORs Recovery Area Nurse	I find [the Main ORs Coordinator] approachable. I think she is approachable. She has given us an impetus and a feeling that we are working in a good environment. Her role is to bring in work and make sure that we keep up with the amount of work.
Main ORs Recovery Area Nurse	If I am not getting results with my recovery staff I come to Dot [nurse matron] and bounce off some ideas. [...] I think that knowing that there is someone in authority that you can approach gives you a good feeling.
Main ORs Recovery Area Nurse	My manager whom I just took over from retired and we all went out together. I think we see it that we are all working towards the same aim, which is the patient, and we work as a team.
Main ORs Recovery Area Nurse	The surgeons... a lot of them we only know the name but we don't associate the name with the face. Maybe because they don't come to recovery. The only time they may come to recovery is to drop the notes or to say hello to the patient, but that is not always. [...]With the anesthesiologist we have to work in close partnership because they rely on us and we rely on them, and I think we have a very good relationship with them. [...] There is no barrier between anesthesiologist and nurse, but I feel that there is a barrier between surgeons and nurses.
Main ORs Recovery Area Nurse	Approachability... no matter what the problem is you are able to take the problem to them and that they will be there to help. We have access to beep numbers, we have access to the registrar, and to the junior registrar, and we have 24 access. We can also go around to the operating theater if we have a problem.
Main ORs Matron	Our porters are of a breed here... how to say this politely... I don't know how to say it... some of them are just plain thick! I believe that if you put porters through a basic training program we could handle the handoff better. For instance porters should not bring down patients if they are not consented. Porters have to be able to speak English and be understood so as to have a better idea of how to deal with people
Main ORs Surgeon 2	In surgery basically the surgeons have a quite strong ego and we are quite selfish as well so when a big ego bumps into another big ego there is some friction, some conflict of interest, some conflict on conditions, that once in a

	while can happen… and I have a culture coming from [the] south of Europe so I talk directly… and then you see that it isn't working, or if there is not will, no wish to talk directly … then I will invite a third party or a third person… a clinical director… a colleague… or a manager… Fortunately over three years I have had three problems to solve…
Main ORs Surgeon 2	Even in the daily department life, we have department meetings every week where I have never seen a ward sister invited to any department meeting… and that is [Hospital ABC]… and I have never seen that before in my life! It could be an M&M meeting… by invitation we can have someone invited to one of these meetings but it is really uncommon and not a formal requirement. […] We cannot say that wards are part of the surgical team and I would not blame anyone… we are the surgeons so we are the source to blame… we should extend the invitation… even if it is not organized… even if we don't have a strong structure to help that…
Main ORs Surgeon 1	"Or they will send someone to their coffee break when they are changing patients around, and that for me is stupidity. When you are setup and in full flight of surgery you can send someone for a coffee break or a lunch break, so that you are in the case, you still got one runner [nurse fetching material], and you have one person to spare, and the other can go for the break. I have no objections to that. But when you are right in the middle of turning around I expect that turn around to be quick and I don't want anybody leaving… and that is not happening."
Main ORs Anesthesiologist	"There is lots of flexibility… the thing is if somebody makes a move… I had a list like that with 14 patients on it… I would run around and find theater space for those patients to go to because I don't want to stay here until 10 o'clock at night. So if you make people aware of that it always works… But there isn't much proactivity to making people aware, especially of empty theaters"
Main ORs Surgeon 2	The situation is that day by day everybody does the best but in terms of no strong ward culture and no link between ward and theatre, then I say there is no link… the link is a porter with a form with a ticking box on either side to make sure everything is safe… but it is not strong. [Inpatient service units should have] similar activities… I don't say organs… If you do laparoscopic colon or gold bladder or kidney it is quite the same kind of thing and explanation to the patient, so similar activities could be on the same ward. And then once we know from that ward there is a similar activity, then the whole team can have a better feedback and a better feeling of what is going on the ward.
Main ORs Surgeon 2	And have more direct contact… because there is nothing wrong in my opinion that in a normal rotation for ward sister, or ward nurse, or a member of the ward involved with patients, could accompany the patient to the theatre and maybe see part of the procedure. Some part of the ward staff time should be allocated for them to go to the theatres. And the same, a couple of hours in a month, would not harm for theater staff to have formal contact with a patient on the ward, and it might not be always the one you have seen in theater, but why not, and the patient would possibly think it is good…
Main ORs Surgeon 2	I know that the NHS allows private work out of the NHS time. NHS consultant has a contract in a private provider outside of [Hospital ABC] and on the evening… and it is amazing because you see normal activity after 5…. So surgeons run a second job. […] So it is completely private… it is private insurance… just like you have in the states [US].

	[Hospital ABC] has a small unit which is a private wing… where surgeons with a contract at [Hospital ABC] are allowed to bring their [private] patient and then it is the same, surgeons are paid privately by the insurers, and it brings money for [Hospital ABC]of course because on the normal bill 20% might be for the surgeon and then 80% is for the Trust… but it is not a massive activity… It is a significant source of income for the Trust and for surgeons as well. […] And the surgeons use the same teams as they would in any other day. However the rule is out of NHS hours… this means after 5.30pm or on Saturdays.
Main ORs Surgeon 2	We have the same for meeting targets you can be paid extra PA [Program Activities]. Each Program Activity is 4 hours and you have a job plan… that says your job is 10PA a week, or 11, or 12… for those who are on 12 PA… usually they would not be [on more than 12PA]… So for longer day or another half day where you are not supposed to work in theater, those who are on 10PA they will get this extra money. Those who are already in 48 hours contract will get nothing [i.e. 48 hours is 12PA]. But nobody in 12PA will complaint. I am on 12PA and I will not complaint.
Main ORs Recovery Area Nurse	We try to accommodate requested days off as much as possible. Staff can put requests in the diary and when it comes to us doing the work schedule we try to accommodate their request. It is not always possible to get all the requests. But what we try to say is at least 2 requests per week [are satisfied].
Main ORs Recovery Area Nurse	In the recovery sometimes we bring food in. We have a diverse workforce and we try to bring food from each nurse. We have African, Sri Lanka, … Apart from that there isn't much else really.
Main ORs Surgeon 1	"One of the thing that drives me up the wall is… lets say I am changing cases… I do a case… we send for the patient… often I will say send for the patient… finish the case… I finished the cholangiogram on a lap chole [laparoscopic cholecysectomy] and as soon as I have done that I know you can send for the patient because by the time I turn around, finish this, the next patient should be there in 15 minutes. What happens? Depends how the staff are feeling. If they are feeling sort of a bit tired they will slow down and they won't quite send. The whole thing slows down because the faster they work the less break they get. They don't get a break. They have to clear the theater. Wash the theater. It is the same 3 staff. Clean the theater, get the next patient ready, etc. There is not enough staff to do that. So what incentive is it for them to try to stress themselves out? None."
Main ORs Surgeon 1	"the turnaround between theatres is slow and there is no incentive driven approach. Lets say we have three cases and we finish by 2pm… what happens? Well, you get sent to other theatres or they have to do other things… they don't go home. Or lets say that you finish late? Well you just carry on and finish late. So where is the incentive to finish early? […] The simplest thing to do is that you say "This is your list. As soon as you finish your list you go home. We won't expect you to do other things". And that doesn't happen."
Main ORs Surgeon 1	"on the Saturday and the Sunday, because the nursing staff get paid per hour they prolong the thing. There is an absolute link between the financial incentive and productivity. You watch if I put two cases on, on a Sunday, turnover staff, they are late, or in between there will be an extra hour or something, and there is a direct knock on effect. […]The other system is the more throughput you have the more bonus you get as part of a bonus system.

	[...] There is no doubt if you say... this is our target, achieve 150 cases within the year, 3 cases a day, whatever, we'll make sure we give you a 10% raise in your pay pack. But the other important thing is that once people get finished they can go home and don't have to go into the other theater. That sort of change will drive efficiency through theatres"
Main ORs Surgeon 2	we have a system of awards, clinical experience awards. It is a scale of 1 to 9 where the first 6 are local awards and the last 3 are national awards. That is a significant amount of increase of the wage as a bonus. But you have to deserve it. At the moment the Clinical Experience Award is 20% of my salary. There is a funding annually for that in the hospital and [chuckle] there is a committee with some kind of competition you apply for and the committee has people from the Trust and colleagues. [...] but it is some kind of waiting list or outcome in performance or a way to say thank you. Those who will contribute a bit more to the hospital...

Main ORs Knowledge View

Interviewee	**Interview quote(s)**
Main ORs Matron	Our porters are of a breed here... how to say this politely... I don't know how to say it... some of them are just plain thick! I believe that if you put porters through a basic training program we could handle the handoff better. For instance porters should not bring down patients if they are not consented. Porters have to be able to speak English and be understood so as to have a better idea of how to deal with people
Main ORs Anesthesiologist	ODAs might be either saying, I am only working in theater 3 but not in theater 8, or they might be saying I am specialized in pediatrics but I cannot do a general thoracic case. And a coordinator would have the task of juggling that around and say okay, this person goes here, this person goes here, and that would make things go much more smoothly [...] You need the capability, the leadership skill, and you need the knowledge of what the specific nurse or nurse anesthesiologist can do and cannot do, and should you allot someone else.
Main ORs Anesthesiologist	Well consultant here thinks that you are basically an independent practitioner. So you are basically free to practice the way you think is reasonable. Having said that you are expected to know the NICE guidelines and [Hospital ABC] guidelines. So we have internal guidelines too.
Main ORs Anesthesiologist	**[JF: When you are about to put the patient to sleep, how common is it for the surgeon to be present when that happens?]** Less than 10%.
Main ORs Anesthesiologist	"[The Main ORs Coordinator] can't tell the consultant surgeon anything that he won't do right now. It sometimes means that the surgeon has to wait for 10 minutes for something, and he will go mad about that and he will insist "no this is my list... I want this theater now". At that stage, you need a person who is capable of saying to another consultant "no, you are wrong, we need the theater now, and you get theater 5 in 10 minutes". [...] If you have multiple specialties [in a hospital] you need a consultant anesthesiologist to fulfill the role of theatre coordinator"
Main ORs Surgeon 1	"I think the Trust basically needs to think "well, you have not completed 70% of your mandatory teaching" then there needs to be some fine...you won't get any of your study leave money, or your study leave... which is a sort of incentive that could be quite useful. If you are fulfilling your educational role

	within the institution then we shouldn't be sending you up for education outside of the institution. [...] If you do not fulfill 70% to 80% of your audit, etc, then you are not eligible to receive Clinical Excellence. This should include audits and teaching commitments. And all of this should have a Friday morning teaching commitment where we are all actually in there teaching the juniors as a team. And that is not happening. [...]and you know things like infection control policy, etc, and all these things that everybody forgets every six months, we would really learn about it."
Main ORs Surgeon 1	[chuckles] Okay. Evidence based medicine is a great terminology and how much evidence based medicine do you practice. In theatres most of what I do tends to move towards evidence based so evidence based tells me that I shouldn't be putting drains in my operations after surgery... it doesn't make any difference... they are more painful... and that we shouldn't do them. Common sense tells me that if I have a pancreatic leak, I then have a drain, it is a major problem, and I have to then get a drain in place for containing it. Evidence based is formed on meta analysis not looking at all the work but just looking at drains in surgery overall. So do I take an overall picture and apply it to my specific condition, the answer is no. So I don't practice it in that situation. But... I do think about it.
Main ORs Surgeon 1	A timeout is done in the theater... do I take part in it? No... that is the biggest waste of time there is and I'll tell you why... because if I don't know that patient and I haven't seen that patient, I don't know what operation I am doing, then I shouldn't be doing it. I strongly believe that. [...]I do my own checklist in my head.
Main ORs Surgeon 2	I don't rely on metrics on a day to day basis... it is more of post information... "this has happened" and we note down the step further action will be taken... it is far from a daily concern.
Main ORs Surgeon 2	**[JF: Do you think it would be useful to have it [daily indicators]?]** Oh yes! I think that any modern way of thinking, management, or anticipating is the basis of quality and performance.
Main ORs Recovery Area Nurse	On any given shift we try to have at least 6 or 7 staff members in the main recovery. In the obstetrics theatre there is always 1 member of staff on. In the neurological theatre there is always 3 members of staff on. In the neurological recovery you always rotate the staff, you never have 1 member of staff working there permanently. We rotate so that everybody gets to work in the different disciplines.

Main ORs Information View

Interviewee	Interview quote(s)
Main ORs Matron	Then the [patient] slip which is held in the theatre is taken to the holding bay so that the holding bay nurse can give it to the porter who in turn will go get the patient from the ward.
Main ORs Recovery Area Nurse	We try to accommodate requested days off as much as possible. Staff can put requests in the diary and when it comes to us doing the work schedule we try to accommodate their request
Main ORs Recovery Area Nurse	The majority of times [the post operative notes are] written by hand. Occasionally we are now getting some surgeons using computerized, and we would have to print that out. They use a word processing package.

b. Administrative Support Services

Administrative Support Services External / Policy View

Interviewee	Interview quote(s)
OR Management Board Surgeon	In addition to that we have had the implementation of the European Working Time Directive. Now at the risk of sounding like an old fart, when I first started training I finished my first undergraduate degree in 1985, I was scheduled for 112 hours a week, scheduled... I am now implementing this year 48 hours max for my trainees. Now it doesn't take Einstein to work out that there is an awful drop in clinical experience and exposure from that length of time. It has really been cut by around about a quarter which is a huge amount! [...]there is an increasing awareness that we are not training our senior trainees to a consultant level at the time where they are being appointed to the consultant level with the necessary expertise and breadth of experience and that is reflective by the number of consultants who get into trouble in the first few years of their practice, and are suspended
OR Management Board Chairman	[patient flow] is more and more important because of the 18 week target and clock watching etc.
Main ORs Coordinator	Patient flow and all those things matter but today what is very fashionable to Darzi, and all of that, is that whatever you do needs to have a patient experience focus, and quality of care, and patient involvement. These are very buzz words which we are trying to underpin what we are doing.
Anesthetic Delivery Manager	We have to meet national targets... [...]Say I have a sore knee and go to the orthopedic clinic and the consultant has a look at my knee and says that you are going to need surgery for XYZ. That starts your treatment [18 weeks] clock and you have to be treated within that.
Lean Team Director	18 weeks has been a big forcing feature... we are clearly understanding it in a way we didn't before about the fact that we haven't got enough capacity to do the work that we have got to do and therefore we have got to be more efficient in order to sustain our position... and I think that is the big strategic change.
Surgery and Critical Care Director	What I did in my specialties... This is a gross simplification but we don't have time to talk about all the details... What I tell my specialties is "look you will not be able to keep your referral base... we will have to chop it off at the knees essentially if you don't hit 18 weeks...

Administrative Support Services Strategy View

Interviewee	Interview quote(s)
Anesthetic Delivery Manager	from the point of view of a patient it is the fact that it is a local hospital that can provide me with just about any service and I am going to get good care and it is a good hospital
Surgery and Critical Care Director	They need to make a surgeon who is top class think that this is a place I want to work.
OR Management Board Chairman	There is a general acceptance that the patients that we are dealing here are getting more and more complex because we are distilling out as a tertiary center, but still you have a big aspect of what you call a district general hospital which provides local services to the local population.
Surgery and	I think it is a fantastic tertiary but local service focused hospital. It is really

Critical Care Director	embedded in our population. We lose that at our peril as we might seek other sort of reputation in the national our international scene.
OR Management Board Chairman	The things that could be improved and where resource may be necessary is from right through the system... the way the patient is placed on the waiting list... where their pre assessment is, how they highlight those individuals who fail the pre assessment and then get an anesthetic assessment... but because of resource it means that you have to have an anesthesiologist available to actually pick these patients up... but it is timed and money well spent in terms of actually allocating that individual to get the appropriate investigations, etc... and that is more and more important because of the 18 week target and clock watching etc.

Administrative Support Services Service View

Interviewee	Interview quote(s)
OR Management Board Chairman	I think there could be an awful lot more coordination between theatres and the wards, and the way the patients are prepared in a timely manner, and coordinated to know that those patients are going to be there
OR Management Board Chairman	cardiac came out with the fact that this is how they wanted to run the surgery "I want three cases in the day". Anesthesiologists say "you can't do that". Okay sit in a room and tell us how you might do it and what are the resource implications for that together with your business manager, and then came back to us and say "actually we need an extra recovery bed... we need the theater team to work over lunch time if we can actually start anesthetizing the second cardiac case as the other one is still coming off the table
Main ORs Coordinator	So each one of these slots are filed, we know that because that is the timetable, that is the job plan for the consultant surgeon and the job plan for the consultant anesthesiologist. What is going to interfere with that? Poor communication. [...]The rule in the country is that if you were treating your elective patients correctly, the guidelines say that you should give patients at least three weeks notice. So if we are going to tell Ms. Bloggs to come in three weeks prior, shouldn't she be on the system? Why should it be a grand surprise? This also impacts the patient experience.
Main ORs Coordinator	We see ourselves as the piggy in the middle. The patients come from the wards to us, and they go from us to the wards. Many of our issues result from the ward not preparing... I am not painting them out to be bad... again it is also the fault of pre assessment. Failures occur in pre assessment and those then pressure the ward [which in turn pressure us with additional failure]
Main ORs Coordinator	Sterilization of all items is done offsite. That in itself can be a bottleneck. Firstly because it is off site. And because it is offsite the turnaround time is 18 hours from the time the instruments leave our department and come back. We have increased our supplies to cope with that turnaround but we still don't have enough buffer. [...] The areas where we are having a crunch specifically is the areas that are specialized. Orthopedics, the surgeons are the biggest toy lovers under the sun. They are prone to the innovation that is going on nationally. They go off to conferences and speak with their colleagues. So they want the latest material which is expensive and we don't have many of them to build a buffer.
Main ORs Coordinator	Our peak times early in the morning we never have enough porters. Then once the dust has settle they just sit down all day.
Main ORs Coordinator	Communication is always the fundamental cause [as to why things don't work well]. He didn't tell me bla bla. Generally communication fails within the theatre,

	or with other people outside, ... people assume and assume and assume... 9 time out of 10 problems are because of communication. [...]Communication breaks down in between cases... have you called for the patient... have you called the ward?
Anesthetic Delivery Manager	You could open up a patient and realize a complication, unforeseen procedure, and the list will overrun. Those happen daily but not in huge volume in the theatres.
Anesthetic Delivery Manager	Information should be made accessible easily for all the decision making stakeholders, and whenever a change takes place, instead of the information going back to only one stakeholder, it should be made available to all the stakeholders affected by that change. Ensuring that the flow of the information and the information are there as a resource.
OR Management Board Surgeon	On the whole the concept is on-the-day admission. The intention is that the patients arrive at 6 or 7 in the morning. What hasn't been thought of and I think it is an infrastructure issue, is that the wards staff are trying to give care to patients who are ill, and who need to be gotten out of bed, or whatever, and they are trying to admit patients at the same time. You know, where is your priority?

Administrative Support Services Process View

Interviewee	**Interview quote(s)**
Main ORs Coordinator	In First Choice we stipulated that one theater do a difficult case and another theater do an easy case. An example would be for orthopedics to do a hip in one and a toe in another. They used to do it and it helped scheduling, but now they seem to have forgotten because they don't open the first choice manual anymore. So whichever anesthesiologist gets there first, he moves the patient first into the anesthesiologist room, and that may mean a longer wait time if his case is more difficult, and during that time the subsequent patient is waiting longer in the holding bay.
Surgery and Critical Care Director	Then you hit the problem which is, on one end of the spectrum you've got a lot of people who believe "well we just haven't systemized this... we haven't got the processes in place". Now what we may have been incompetent in isn't for the want of trying, that is what we have been doing for three years with first choice.
Lean Team Director	Theatres had their own work streams in terms of scheduling, list planning, change over, visual management, 5 S, etc... and we worked incredibly hard for about a year and a half doing stuff and some stuff stuck... so there is a degree of visual management in place... 5 S did some good work... scheduling never got off the ground.
Lean Team Director	The other thing that I think was fundamentally wrong was that there was no strategic approach. Why do we need to do this? What is the benefit of doing this? What is the better future that this improvement will actually make happen? [...] So basically what we did was that we crashed landed... with no prior warning... with no engagement up front... with no strategic direction and just said that we have got to get in there and start doing stuff... and guess what... the management team didn't really buy it...the general manager never really got it and didn't buy it, she was being done too.
Lean Team Director	There was no preliminary engagement with the care group to say "what would your preliminary thoughts about this be? How do you think things might improve? What was your preferred way of doing this be? What sort of back fill would you need if you were going to get involved in doing this work?"

Main ORs Coordinator	[employee xyz] has been charged to finding out every day why patients cancelled a surgery on the day.
Main ORs Coordinator	Galaxy was a new system for the Trust and it is meant to be a patient information and management system, and yet, it does not have the capacity to give us data on the top ten procedures for each surgeon.
Anesthetic Delivery Manager	Say I have a sore knee and go to the orthopedic clinic and the consultant has a look at my knee and says that you are going to need surgery for XYZ. That starts your treatment [18 weeks] clock and you have to be treated within that. That information will then be passed onto an admissions team and a waiting list card is put together, kept, and that is then used to organize a list according to the surgeons preference and the urgency to treat the patient. Sometimes some surgeons just let their admissions team organize it for them and they will just approve it. The admissions team will then maintain the list appropriately because every surgeon works differently…
Anesthetic Delivery Manager	If we have got patients coming off the ward, so they are already an inpatient and have not needed to go through the admissions process, the admissions teams might not know of it… or if there is a last minute change because of an urgent patient coming in… […]While doing rounds surgeons may decide to squeeze in an extra patient for the next day and put the junior doctor to schedule it, however the admissions team may never get to know about it
Anesthetic Delivery Manager	From a systems point of view, the entire trust, we have a system called galaxy that could be used for electronically scheduling patients, people's [consultant's paper] diaries are still used and it is a big request of mine because what it would mean is that you would be able to give access to, or front view access, to anybody that could log on and see what the list was. So theatres and admission wouldn't have to have papers going back and forth. It would save in administration's time, it would spare junior doctors going all around writing up the list for the next day, permission to get into theatres and then have to spend an hour and a half typing in medical lines, etc whereas if we had people actually directly inputting it into Galaxy I think that would make a big difference. Galaxy already has the capability to do this.
Main ORs Coordinator	The final version [of the OR list] is made available at 3pm the day before. But prior to that we have the galaxy system, and all specialists, neuro, cardio, gyn, general, everybody, that does not happen here! They need to feed into galaxy all the data to enable us to plan for the list. […] They can do it whenever they want. The rule in the country is that if you were treating your elective patients correctly, the guidelines say that you should give patients at least three weeks notice. So if we are going to tell Ms. Bloggs to come in three weeks prior, shouldn't she be on the system? Why should it be a grand surprise? This also impacts the patient experience.
Main ORs Coordinator	The day before we get the definite list for the next day. Yesterday, by 3pm the lists flow in by the junior doctors who hand them in at the theatre reception desk. The lady at the desk, the admin person, collects the lists and puts them all into Galaxy which produces the workplan for the next day. When the list is prepared our senior team leaders in here go to the desk in the afternoon, look at the list, and see if it is a realistic list [are there too many cases], is it too ambitious, etc… if so they are meant to call the consultant… and say this is too ambitious, you will not finish this work, …but 9 times out of 10 when they check with the ambitious consultant and he will say that he can do it anyway and the list will not

	be changed. That is their role.
Main ORs Coordinator	junior doctor [staffed at the ward] will need to come physically to the theatre and book the patient a theatre slot. At that point we give him [junior doctor] a form to answer all these questions and if he answers "no" to one of them we say "sorry matty we don't take your booking because the patient has not been prepped and ready to be operated on, or else we are just queuing up". And guess what the junior doctor does? He ticks "yes" to all the questions even though half of them the answer is "no".
Main ORs Coordinator	[Surgeon XYZ] said that he was ill and that he wasn't coming in. Guess what, he showed up! So on Friday there was a big scramble on our service to reinstate that list. But the patients that were originally scheduled were cancelled. He used that list to mop up emergencies, and what have you.
ORMB Chairman	I think that there is a lot to be done in terms of the processes within theatres about who has a role, what that role is, and what the system is. There hasn't been that didactic flow realistically specified. There are people who have had that role but if you actually look at their job plan and job description, it is not there, and that has to change.

Administrative Support Services Organization View

Interviewee	**Interview quote(s)**
Surgery and Critical Care Division Director	They also have to do intangibles that are important. They need to make a surgeon who is top class think that this is a place I want to work. They need to make an anesthesiologist feel like I am not just doing a service job here, you know, this is a place where I want to work. It has got to create that atmosphere.
Main ORs Coordinator	It is always the poor junior doctor that is tasked to track the patient and everything else. [...]From our point of view, our staff needs to support the junior doctors in doing their activities because they need to know the inside out and upside down of how we work.
Surgery and Critical Care Division Director	What I tell my specialties is "look you will not be able to keep your referral base... we will have to chop it off at the knees essentially if you don't hit 18 weeks... and to hit 18 weeks use that theatre time... you are not getting paid to do loads of lists at weekends... this is not going to be the gravy train it was for previous waiting list initiatives... so don't believe that having a long waiting list is going to end up with you just being paid loads more money.
ORMB Chairman	Or alternatively budget for the fact that this list is always going to run until 7 and staff it appropriately with appropriate resource. That is the problem... they are doing on the cheap at the moment.
Surgery and Critical Care Division Director	One of the problems I had was when I said to the executive 'look unless you are prepared to act like the hard policeman on this one, on occasion, it is made very difficult for me, you know', [Executive answered] 'you are telling me we won't be able to do this work... if you don't hit 18 weeks'. [division director] 'Are you going to tell the surgeons that?' [Executive answered] 'No. You can tell them'. Thank you very much."
Anesthetic Delivery Manager	It takes them nearly 10 years or so to get them to the top of their consultant scale.
ORMB Chairman	[The SCC division director] helped with this whereby in theory the funding for allocation for your specialty for the year were given to you. So if you make savings on that list in theory you could actually utilize some of that money to

	reinvest in maybe other areas of your specialty, maybe a bit of hardware, a bit of equipment, this sort of thing.
Main ORs Coordinator	Once a month the Trust has what they call an Audit. It happens for a morning session 8am until 12am. In theatres we use that time to have our team meetings, information sharing, etc. [...] Once a month is not enough. However in a world where we are trying to achieve 18 weeks targets, it is precious resources to stand down. If you think about it, once a month all our theatres stop one morning.
Main ORs Coordinator	The caregroup siloed structure could be an interference, because do remember that theaters, here we are a commonality, but we've got cardiac and neuro that belong to another caregroup, they belong to cardio and neuro sciences, then general surgery , orthopedics, and urology belong to critical care and surgery, then gyn and peds belong to what they call the women's and children care group, and then liver and renal belong to the liver and renal care groups. But theaters here manage all these theaters that service all these care groups, and yet they see themselves as in their own entirety. [...] So all the surgeons belong to each care group. But the anesthesiologists and the theater staff belong to critical care and surgery. But the allegiances of these surgeons is to those care groups. But I would like to think that the allegiance of the theater staff is to me.
Anesthetic Delivery Manager	Everybody works in silos... is that because you have direct relationship between the surgeons and their admissions... they tend to stick very close to their offices... they don't have to have a phone conversation with someone on the other end of the hospital. Those silos foster the relationships between them.
Anesthetic Delivery Manager	you are dealing with clinical staff who have historically been self managed. For someone to come in micro managing and request accounts for what each consultant actually did for an SPA... my feel... you would have a jerked reaction.
Anesthetic Delivery Manager	I can only speak about my care group and I don't know about the other care groups [...]Where there are shared resources between anesthetics and theatres that is when you see everybody's needs and priorities, but is there a good information flow? Is there good work happening in neuro surgery, do general surgery necessarily know about it? Are we actually duplicating work in the different Care Groups? Are we purchasing the different systems to do the same purpose in different areas? Because there isn't a lot of centralization... Procurement decisions are up to each individual care group. Things that happen in the ward, for the sake of the patient, is that information passed on to the rest of the hospital?
Anesthetic Delivery Manager	The neuro anesthesiologists when you speak with [lead surgeon X], I sometimes think that he would very much like to be a complete discrete group. However, some of their members of staff, the neuro anesthesia and general anesthesia, they don't conflict, therefore there is room for cross covering, they are still part of the theatre complex. If there is an issue with anesthesia who is going to support with the structure within that? If you start moving those groups into isolation then their voices actually starts getting smaller as well because they don't have the backup and support from a very large department
Anesthetic Delivery Manager	Each Cares Group Admission Team... this is the Care Group of Surgery and Critical Care, so the surgical specialties that sit with this care group are general surgery, orthopedics, ophthalmology, and urology. Neuro surgery has their own team and systems of admissions. Liver has their own team and systems of admissions. Surgery has their own team and systems of admissions. So there is lots of different systems... There is not a central admissions resource in this Trust.

Main ORs Coordinator	To penalize them financially immediately wouldn't make sense. But we could give them a year to try to get culture to change and run this in shadow mode… and then you could start penalizing them. Then theaters would start minting money because it would show!
Main ORs Coordinator	We are using [the ORISG] as the means of communication to bridge the gap and address the issues rather than just complaint, and complaint, and complaint.
Main ORs Coordinator	If a session is cancelled for a non clinical reason, someone in the theater has to tell the matron, who then tells me, and I then talk with the consultant and tell him that he has to make up for it and overrun if need be. If he says no then I bring [the care group manager] but it happens rarely. Then the surgeon will complaint [she mimics the voice] "can't do it… got to collect the children", but [the care group manager] tells them "you signed up for this list, so some days you go early, some days you stay overtime!".
ORMB Chairman	My idea was to have the surgeon, the anesthesiologist, the theater team, and the business manager, very importantly, rather than having this conversation five times over, the anesthesiologist speak to the surgeon, the surgeon speak with the business manager, back and forth, you need this little cohort groups on how to best manage and then bring that back to the theater management board and say "this is what we have done. We are appointing another consultant because that way it frees up so and so to do this, and do that, etc".
ORMB Chairman	[The environment between management and surgeons] is usually hostile but that is why we try to do it through the Theatre Management Board and see people respond. This is where it should be discussed. If you have a group that are not playing ball, that has to go up the line… as it would be beneficial to have someone with clout at those meetings that people have to listen to, and that takes away some of the issues with regards to [the Main ORs Coordinator] and the way this information is being disseminated.
ORMB Chairman	So people like cardiac came out with the fact that this is how they wanted to run the surgery "I want three cases in the day". Anesthesiologists say "you can't do that". Okay sit in a room and tell us how you might do it and what are the resource implications for that together with your business manager, and then came back to us and say "actually we need an extra recovery bed… we need the theater team to work over lunch time if we can actually start anesthetizing the second cardiac case as the other one is still coming off the table".
ORMB Chairman	There was also the fact that the people needed to meet with their business and clinical managers because they never really used to turn up for that meeting… it was nothing for them… they didn't need to worry about that. But actually when you are being dragged across the cold and say "you're theatre occupancy is poor… your late starts are poor… your bla… what are you going to do about it?". All of the sudden "oh right okay".
ORMB Chairman	Get them [break out groups] to take ownership of their figures and be accountable for them, and come back to the [main] meeting. But also then, to discuss with the lead for anesthetics for that group, the clinical lead of surgery for that group, and also the theatres teams, to say "okay here are the figures, this is what we aren't doing very well, how could we possibly change this?"
ORMB Chairman	The SCC division director sits on the ORMB] occasionally, as the manager for critical care and surgery, but usually there is nobody anymore senior than that position who sits at that meeting.
ORMB Chairman	We have talked about late starts… on day cancellations… number of lists cancelled without notification. These are the ones [issues] that count.

ORMB Chairman	There are several individuals who are happy with the status quo and will try to disenchant other people coming in, and make sure that it doesn't change, and then they are going to leave. They are interested in keeping it as is. Our interest is to make it a more dynamic and flexible work force
ORMB Chairman	It is on the crest of changing now… it really is… and if you can energize this now and put the resource where it needs to be so that people can see that it is changing… they will take that message for only so long… and if not, it will only slip back… and I really do think that making sure that the clinical leads know that an executive member of the board has taken a keen role in this and filtering it back with the odd email and things along those lines
Anesthetic Delivery Manager	What you tend to find is that you have the same surgeon and the same anesthesiologist working together in building a relationship and they work together regularly, the efficiency of that list tends to run better, because they know the types of patients that are coming and they know how a surgeon operates.
Main ORs Coordinator	I genuinely believe that the reason for the communication breakdown… is that if they give you a reason for why they didn't do it, it excuses them… "Oh this is the NHS, what do you expect?". Instead of saying "I am accountable". This happens because there isn't any penalty for failure.
Anesthetic Delivery Manager	It depends who the individual is, the seniority of that individual, and the management style of that person. The consultants tend to relate to the [SCC division director]]. They relate to that level of management. His style is very direct, he makes decisions, and some people don't like that… But you might have other hospital managers that have different styles. The general manager sets the tone of the way in which the care group works.
SCC Division Director	More recently because of some of the capacity crunch on the Trust, I don't know if it is a complaint, but there certainly have been far bigger issues and tensions around how do we find more time for neurosurgery
Lean Team Director	To be blunt I think the management lead in theatres, [Main ORs Coordinator], has been a significantly weak presence all the way through. We have just never managed to get past that. So we bumbled along… keep doing stuff… keep tinkering… but we never really got to the big issues.
ORMB Chairman	You need a theatre coordinator there… and the problem is that there is nobody there whose designated job it is to be on the floor of that theatre complex, day in, day out, running around, coordinating between emergency theatres and elective theatres. [Main ORs Coordinator] is in her office stuck up to her eyeballs in paper work. [Main ORs Matron] likewise. […] What I asked is who would be best placed to be a theater coordinator to liaise, so that when a theater list goes down, at 2 o'clock in the afternoon, who liaises with the anesthetic consultant in the emergency theater, and that consultant anesthesiologist and say "hey, we can take an appendix on our list now" and not for the theaters teams to go, keep their head down, we finished early, we are not here.
SCC Division Director	Main theatres is much better as a crude indicator but if you actually drill down, well I think we have made some pretty big behavioral…I don't want to use the phrase culture because it is thrown about willy nilly and it is far more complex than people think. But behaviorally we have made it so that it is not acceptable to start late and it probably was ten months ago. People know we are looking at this stuff.
SCC Division	Sometimes they will imply "who the bloody hell are you to tell me what to do?" but I say "look I am the divisional manager, and believe me this is not a clinical

Director	issue, it is a misconduct issue". So in a sense I have had to be very firm and I suspect a little bit in the past that that was not what people thought.
ORMB Chairman	Who designs theater lists... I firmly believe that the theater list should reside in the hands of the surgeon and anesthesiologist who actually go do that list. I, in fairness, do not want a manager booking my list because the variables about that list are finite. I know the case, I know how long it is likely to take, I know whether I have a trainee with me in theatre that day, I know where the patient came from, all of these sorts of things... That might be specific to my specialty but I am sure it is relevant to other specialties.
ORMB Chairman	But the rewards are there and actually it might be that people want to work 2 days and have a third day off because it suits there child care facilities, etc. But theatres have been used to run from 8 to 5, and people have gone into that line of work because it suits them in their family commitments. [...]If you are on a ward you are doing a shift pattern all the time. You are on days... you are on nights... The theatres, trying to get people to work outside those hours, there is a big brick wall there because they are not used to it, it is not the way they were brought up
ORMB Chairman	"This is our target for today." A meeting in the morning [with] surgeon, anesthesiologist, theatre staff, this is the task that is above us, we want to get through this today. We'll incentivize you to do four cases as opposed to three. Not to give you overtime and string it out. If people know that they are going to get some incentive for actually putting through more work through a given time they'll do it.
ORMB Chairman	you also got to be able to reward those people who do well... and it is not that they spent that length of time in a job, it is actually whether they are good at it. [...]And we've seen lots of people leave because they haven't had the opportunities to progress up the ladder and because, quite honestly, there are people who don't want to see them to progress up the ladder because it shows them up for what they earn... they were senior to them but they don't do the extra mile, and therefore they don't want to see someone come in and get the extra point
Main ORs Coordinator	Nothing stays static because we have such a mobile workforce and changing workforce here... The junior doctors stay only for 6 months and they are the bulk of doing a lot of this. You lose continuity when the junior doctor moves.

Administrative Support Services Knowledge View

Interviewee	Interview quote(s)
ORMB Chairman	"I think it is good for [Hospital ABC]. By my very nature I like things when they work well. I hate waste but I also want to make sure that people are reimbursed and feel part of something that they are adding to. It has got to be a team culture. It really has to be. And unfortunately there are several teams that are working in theatres at the moment and what you are looking for is something that is going to bring them all together. [...] There is a perception that there are things that keep popping up that are common to everyone. So that might mean that we need more recovery space across the board. It might be about how the pre admissions setup is designated for all the critical care about how they can get these patients into on day admissions. Reduce through anesthetic pre assessments the number of on day cancellations. Speed things up with some generic things that might need a bit of investment and actually someone with a bit of clout to say "I can see how this is

	going to improve it""
ORMB Chairman	You need a theatre coordinator there... and the problem is that there is nobody there whose designated job it is to be on the floor of that theatre complex, day in, day out, running around, coordinating between emergency theatres and elective theatres. [The Main ORs Coordinator] is in her office stuck up to her eyeballs in paper work. [The Main ORs Matron] likewise. [...] What I asked is who would be best placed to be a theater coordinator to liaise, so that when a theater list goes down, at 2 o'clock in the afternoon, who liaises with the anesthetic consultant in the emergency theater, and that consultant anesthesiologist and say "hey, we can take an appendix on our list now" and not for the theaters teams to go, keep their head down, we finished early, we are not here.
SCC Division Director	Well it was something else about what we started to do to incentives and motivation and strategic imperatives, and performance management, and supporting the staff, and picking up the "this isn't good enough"
Main ORs Coordinator	In First Choice we stipulated that one theater do a difficult case and another theater do an easy case. An example would be for orthopedics to do a hip in one and a toe in another. They used to do it and it helped scheduling, but now they seem to have forgotten because they don't open the first choice manual anymore. So whichever anesthesiologist gets there first, he moves the patient first into the anesthesiologist room, and that may mean a longer wait time if his case is more difficult, and during that time the subsequent patient is waiting longer in the holding bay.
Main ORs Coordinator	Once a month the Trust has what they call an Audit. It happens for a morning session 8am until 12am. In theatres we use that time to have our team meetings, information sharing, etc. [...] Once a month is not enough. However in a world where we are trying to achieve 18 weeks targets, it is precious resources to stand down. If you think about it, once a month all our theatres stop one morning.

Administrative Support Services Information View

Interviewee	**Interview quote(s)**
Anesthetic Delivery Manager	There are so many different systems that don't speak to one another and this is a problem in general with the NHS IT system.
Anesthetic Delivery Manager	This is our annual leave diary [paper] for all our clinicians. [...] Things that I will look out to produce the anesthetic schedule roaster, I use the ROTASTAR system, I would look at the scheduling spreadsheets that [the Main ORs Coordinator] manages and coordinates, I would also double check with [Main OR system], I wouldn't enter or change anything in [Main OR system], but I would use it as a reference point. I would use our own internal systems of leave, booking, so I know who is available to work, but without any robust IT system.
Anesthetic Delivery Manager	The staffing system ROTASTAR is not shared with everyone.
Anesthetic Delivery Manager	It all depends on the relationship between the surgeon and the admissions team are having. And they all work differently. And you would hope there is always a very open communication channel but you don't know where all the information is held
Anesthetic Delivery Manager	There are good relationships between the theater teams, the surgeons, and the junior doctors, and they do communicate, but if you were look at it as a system it would appear very ad hoc. Then if you put in place something very rigorous as a

	system they are worried that that will remove the flexibility to adapt.
Anesthetic Delivery Manager	"Each Cares Group Admission Team... this is the Care Group of Surgery and Critical Care, so the surgical specialties that sit with this care group are general surgery, orthopedics, ophthalmology, and urology. Neuro surgery has their own team and systems of admissions. Liver has their own team and systems of admissions. Surgery has their own team and systems of admissions. So there is lots of different systems... There is not a central admissions resource in this Trust."
	From a systems point of view, the entire trust, we have a system called galaxy that could be used for electronically scheduling patients, people's [consultant's paper] diaries are still used and it is a big request of mine because what it would mean is that you would be able to give access to, or front view access, to anybody that could log on and see what the list was. So theatres and admission wouldn't have to have papers going back and forth. It would save in administration's time, it would spare junior doctors going all around writing up the list for the next day, permission to get into theatres and then have to spend an hour and a half typing in medical lines, etc whereas if we had people actually directly inputting it into [the Main ORs system] I think that would make a big difference. [Main ORs system] already has the capability to do this.
Main ORs Coordinator	The list schedule has a coloring system where it can be green, which means a session is reserved for a surgeon but no patient is booked yet, it can be yellow, which means a patient is booked by the surgeon, it can be orange, which means that the surgeons are on leave, and it can be red, which means the session isn't staffed for. All the surgeons have to give six weeks notice of them going on leave. So the first three weeks the specialty has got to use their resource within their specialty, and if they can't do so, then they come to me, or I check on them, and that means that there are three weeks still for another specialty to use them. I advertise it in an email for all the specialty managers "these are up for grabs, these are the deadlines, come back to me if you can use it". Then there is some take up to that. Then two weeks before the list starts, if I haven't heard from anybody, I go into the system and I make it red, and I stand down the staff. And I cut the cost because they have given me enough notice. Sometimes, when it is pink it means that I have been given too short notice and I am not going to cough the cost, they are, because they have given me less than three weeks notice, and then they go "hum, ah, hum, oh we have gotten a wasted session!"
Main ORs Coordinator	What do we need to know? In order to make these [OR] lists to run correctly, promptly, and adequately, we need to have advance notification of what is being scheduled into it. [...] The final version [of the OR list] is made available at 3pm the day before. But prior to that we have the [Main ORs] system, and all specialists, neuro, cardio, gyn, general, everybody [can use it, but] that does not happen here! [...] They can do it whenever they want. The rule in the country is that if you were treating your elective patients correctly, the guidelines say that you should give patients at least three weeks notice. So if we are going to tell Ms. Bloggs to come in three weeks prior, shouldn't she be on the system? Why should it be a grand surprise? This also impacts the patient experience.
Main ORs Coordinator	a decision is made that the person needs to go to theatre today sometime, and at that point Joe Blogs who is junior doctor [staffed at the ward] will need to come physically to the theatre and book the patient a theatre slot. At that point we give him [junior doctor] a form to answer all these questions and if he answers "no" to one of them we say "sorry matty we don't take your booking because the patient

	has not been prepped and ready to be operated on, or else we are just queuing up". And guess what the junior doctor does? He ticks "yes" to all the questions even though half of them the answer is "no".
Main ORs Coordinator	[The Main ORs information system] was a new system for the Trust and it is meant to be a patient information and management system, and yet, it does not have the capacity to give us data on the top ten procedures for each surgeon. Each person inserts data differently. For instance cataracts they could put "cataract left eye" or they could put "left eye cataract", or they could put "inter ocular lens plus cataract left eye". So the spelling is incorrect and we can't analyze data.
ORMB Chairman	If we say that the criteria is that you cannot wait for more than 2 hours for a certain procedure, and you've got this length of operating on the list, then you either got to jump the list or you are going to have to open another theater. We don't have that level of information at our finger tips.

c. Cardiac ORs

Cardiac ORs External / Policy View

Interviewee	Interview quote(s)
Cardiac ORs Coordinator and Nurse	Cases are booked according to the national target of 18 weeks. Consultants will share cases between them in order to make sure that they meet the target.

Cardiac ORs Strategy View

Interviewee	Interview quote(s)
Cardiac ORs Surgeon	the hospital is risk averse... the NHS is risk averse... the management of this like every other big trust is risk averse... that is changing a bit under foundation status and with surpluses and with things like that but they are risk averse. Meaning that you have to go through a million business cases and try and prove almost the unprovable...
Cardiac ORs Surgeon	There are a couple of phrases that appear a lot at [Hospital ABC] and in emails as well, and they are to do with the understanding of the organization and the formal pathway... so it will say something like "we have a strategic pilot project for X in department Y and having sorted that out we will then roll it out to all areas" and it won't happen! That wave will roll very short and may trickle out by the time it gets to 3 departments beyond that. It won't go everywhere.

Cardiac ORs Service View

Interviewee	Interview quote(s)
Cardiac ORs Clinical Coordinator	The patient arrives in the corridor. I explain to them what is happening. I think they are more worried about what will happen after the surgery. I explain everything, how long the surgery takes, how they get back to the ward, you won't be able to talk because you will have a tube in your mouth, lots of lines attached to monitor, you don't need to worry about going to toilet because there should be a catheter, the nurse will take care of you.
Cardiac ORs Surgeon	I don't favor 24 hour working. No patient wants to be called down at 3 o'clock in the morning to have a routine screw taken out of their elbow or something... that is not life, that is not the way people live...
Cardiac ORs Surgeon	Patients don't comment much on the operating environment... they want to survive and they wanted it to go well... and they are about to have a anesthetic

	and even when they are awake afterwards, they won't remember what you said to them. Just as an aside, one of the common problems in surgery is that patient says "you never told me anything about" whatever afterwards, and the truth is that we tell them repeatedly, but the patient does not remember because of the drugs…. So tell the patient again and again, and tell the family.
Cardiac ORs Surgeon	Consultants interact a lot with patients… maybe not immediately before the operations… but certainly in the outpatient [setting] and in the wards… and awful lot. And that is the same case for the residents.
Cardiac ORs Clinical Coordinator	Every patient goes to CRU and then HDU and then the ward. […]We already have a bed in recovery before the procedure starts.
Cardiac ORs Clinical Coordinator	I send the patient for the morning at 7.20am. The porter will go and get the patient or one of the ward staff. Patient arrives in the corridor, I check in the patient, then I bring the patient to the theater table, and then I hand over everything to [the] anesthetic nurse. My policy is that all the patients should be inside the theater at 8 o'clock. Anesthetics should start by 8 o'clock.
Cardiac ORs Clinical Coordinator	I was not happy with all that the First Choice program had decided so I tried to change all of that. For example, once they used to finish the cardiac case they used to have the anesthetic nurse and the scrub nurse take the patient to recovery. Why should we take the patient to recovery? I decided the registrar for surgical care practitioner should take the patient to the CRU [Cardiac Recovery Unit] so that we can save the time for 20 to 30 minutes. By the time they return we will have cleaned the theater and prepped the patient.
Cardiac ORs Surgeon	I suppose in America you are familiar with an awful lot more technicians and non nurses and non doctors… we are moving that way. And our group in cardio thoracic surgery is way ahead of the others. We have two operating assistants who are nurses, and we have two ward assistants who are nurses but not doctors but they are doing the doctor. So they are like PAs in America, they are Physician's Assistant. [They go to the] ward the night before and say your patient is going to have X tomorrow and we'll need this and this… it is not just to see the patient, get consent, etc but to talk to the ward as well… this is what it is likely to be, this is what we will need, if you have your patient cleaned, washed, ready, and in a gown at 9, we are likely to call at 10, but could you please have the patient fully ready for 9. Instead they [the Main ORs] adopted a just in time approach, oh I think it is 10, lets try to get him ready at 5 to 10, and more often than not it is 10 past 10, and the call comes and they say "oh he is not ready yet… we… we… weren't sure when you were coming in" that sort of thing.

Cardiac ORs Process View

Interviewee	**Interview quote(s)**
Cardiac ORs Clinical Coordinator	We don't have to get bits and pieces… we have what is called a procedure pack for each consultant… so just get the instruments and put them in the procedure pack. […] Anybody can prepare the kit for the next day… usually they finish preparing the kit by 4.30 or 5 o'clock. They finish the shift at 5.30, so before they go home they make sure that both theaters are ready for the next day. And they prepare theater 1 just in case for emergency during the night. […]If anything is missing for the next day they leave me a note, because they know that I will be in by 6.30am and make sure it is here before we send for the patient.
Cardiac ORs Clinical	I check everything before I send for the patient. Do I have enough staff? All the trays are ready? I usually send for the patient at 7.20am.

Coordinator	
Cardiac ORs Clinical Coordinator	once they used to finish the cardiac case they used to have the anesthetic nurse and the scrub nurse take the patient to recovery. Why should we take the patient to recovery? I decided the registrar for surgical care practitioner should take the patient to the CRU [Cardiac Recovery Unit] so that we can save the time for 20 to 30 minutes. By the time they return we will have cleaned the theater and prepped the patient.
Cardiac ORs Surgeon	the nurse in charge of that room should not only be saying "send for the patient now", they should be ringing an hour ahead "we will be sending for you". Because you see, when we say send, we call the holding bay, and the porter gets the ticket and goes and get it. There is nothing wrong with that. But we all ought of done is call the ward an hour before.
Cardiac ORs Surgeon	We have a scorecard care group meeting with all consultants, head of the nursing in cardiac surgery, business manager, head of perfusion, and we all of a discussion and agree. We meet once in every four weeks to check all the improvements and what is missing.

Cardiac ORs Organization View

Interviewee	**Interview quote(s)**
Cardiac ORs Surgeon	The final point which is really the damaging one... Like other hospitals we have a total centralized system, 20 years ago... there was management, there were departments, etc but the money, the this, the that, it all came from there... and then about 20 years ago they divided it up into what we call Care Groups, Clinical Director, I don't care what you call them... Now these aren't Departments because we have always had specialties but they are semi autonomous financial management hubs within the different groups. So we have never fully reconciled this centralized government and this devolved regional government that we have. We do have a sort of constitution about it... we do know who does what... but the real damage is that if one Care Group decides this is how we are going to do our business there is no compulsion on them to do it any other way as long as their bottom line fits with what the central government say we have to do. And the same thing applies to all these little initiatives, or even big initiatives, ...
Cardiac ORs Surgeon	They allow different systems to develop all over the place because of this degree of almost autonomy of these different areas and knowledge does not get shared, best practice does not get shared, economies of scale, or whatever... but also on top of that there is a feeling of relevant independence... there is no sense that this is the way we do things at [Hospital ABC]. Now I don't mean dictatorial bossing of everything everywhere but there ought to be a style, a way, a standard, a behavior, and you notice I am not just talking medicine, I am talking attitudes and relationships. This is the way we think is good, this is the way we do it.
Cardiac ORs Surgeon	There are a couple of phrases that appear a lot at [Hospital ABC] and in emails as well, and they are to do with the understanding of the organization and the formal pathway... so it will say something like "we have a pilot project for X in department Y and having sorted that out we will then roll it out to all areas and..." it won't happen! That wave will roll very short and may trickle out by the time it gets to 3 departments beyond that. It won't go everywhere. And if something is really good then it should be good for everybody. But they counter that by saying "But we are different here!" and my answer is "Oh you are different... you do a different thing... but the principles still apply... it is

	irrelevant whether you are a gynecologist, a dentist, or a heart surgeon… yes all your specifics are different but the basics are the same" but that gets lost.
Cardiac ORs Surgeon	I don't get told what my financial return for this institution last year was… I would like to. All surgeons would like to because they know they generally make money. I am supposed to under the ABC program but that hasn't become real in the way that it should yet and it has been taking so long now… over three years. A lot of things would tie together on that… If you saw my activity… if you saw my economic impact, you could see whether it is dipping up or dipping down… or you could say that you are a really good chap, or that you are not a really good chap… That does not happen in real time.
Cardiac ORs Surgeon	The adverse of that is if you say you must do this tomorrow… I don't care what it is… you must save 2% of your budget instantly or were in trouble… they all think "hey you, buzz off, leave me alone". So there are tensions then between the board and the divisions, and the divisions and the board, and the people below them relate to their own care group much more than they do to the central objectives of the board… and I think that is a real weakness. Because things don't happen…
Cardiac ORs Surgeon	"There are some surgeons that who are fast… there are some surgeons who are slow… there are some surgeons who are very good… and there are some who might not be so good… but they are not the same four groups. We have very slow surgeons who are very good with very good results. Should they be penalized for being slow? I am not so sure. Do their patients go home with less complications and less readmission? Possibly. […] carving them [surgeons] into minutes that really isn't going to work."
Cardiac ORs Surgeon	I am hippy enough to say that all you have to do is bring people together around the shared core objective which is patient care. […] If we share the same objective and when there is real trouble is when there is cultural conflict between the objectives of everybody in the team. […] the second worse thing that can happen to an operative patient, other than the operation not going well, is cancellation.
Cardiac ORs Clinical Coordinator	Sometimes if there is shortage of staff I do 3 cases [myself] per day. I am not going to cancel the case because I have shortage of staff.
Cardiac ORs Surgeon	Waste matters! Waste time… silent space… dead air… that matters. If the list starts at eight then start at eight. If there is to be a second, a third, a fourth patient there should be little change between them. Shortest possible time between this patient and the next one. Unless there is some infection control issue.
Cardiac ORs Surgeon	"I personally think our theatres should run from 7 in the morning to 9 at night, not necessarily with the same surgeon, you wouldn't fly a plane like that either, but we should maximize the use of the plant."
Cardiac ORs Surgeon	we all have been in this for a long time… "What can we do today? We have always done 5 of them." So provided that what was asked in the first place is reasonable…
Cardiac ORs Surgeon	In cardiac surgery there are few cases and very long. There are two lists and your first one overran by two hours. People who will want to go home early will often say "well it is too late now, you know, it is 3pm in the afternoon, we are not going to send for a 5 hour operation". She never does that. Within reason she says, this is what we are doing.
Cardiac ORs Surgeon	We have a new theater manager for the last year or so, and the one thing that she made clear at the start, and she has not given up on since, is that she will do

	whatever she can to do our reasonable quota of work and avoid cancellations. [...] If people take the piss and persistently abuse the system she will tell them this is not the way we ought to do it, this is not reasonable, etc.
Cardiac ORs Clinical Coordinator	if it is an overloaded list I can say that I am not happy to do that list because I cannot accommodate that much cases in one day. I can speak with the consultant and say that I am not able to do 7 cases in one day, rather than cancelling on the day. Usually 99% of the time we are okay but I always check to see if there is a problem with the list.
Cardiac ORs Clinical Coordinator	I say "if anybody not happy to follow my lead, you can go anywhere". I can tell them to go somewhere else. It is not my decision to say whether they can work here or not, but I let them know that perhaps it is best for them to think of working somewhere else.
Cardiac ORs Surgeon	Specially where behaviors are inappropriate or persistently inappropriate... by a little element of exposure, not of them, but of exposure of the general environment, and what other people can be like, they are encouraged to subtly modify their behavior.
Cardiac ORs Clinical Coordinator	I planned for 6 months how to change things... it is all culture... for years people do something and they don't want to change suddenly. So I have to plan my own each of the steps I should do each month. I can't change everything together. [...] I did speak to the clinical director and explained my plan as to how the department should be run. They used to do hardly one or two cases a day, and we started doing three cases per day in one theater! [...] He [the medical director] knew what I was capable of doing for the past 2 months. Then whatever you say they will trust you. It is trust, you have to get it from everybody. I do at least one case a week with each one of the consultants, so I do 6 cases, because they need to see that I am part of them. Sometimes if there is shortage of staff I do 3 cases [myself] per day. I am not going to cancel the case because I have shortage of staff. [...] The first big problem was that the staff didn't know what was expected sometimes. I had an interior meeting with all the members of the staff and told them "tell me what you feel and how long have you worked in this place?". "Tell me your experience working here for three years?" and they usually say "I don't have coffee break... I don't have lunch break... every day we need to stay back... there is no organization... things are missing". Everybody had their own complaints. So I collected everybody's complaints and what they thought was positive as well. I met all of them separately. [...] Still there might be a change during nighttime when I am not here. I come everyday at 6.30am to 6.45am to check. My duty starts at 7.30am but I will come much earlier.
Cardiac ORs Clinical Coordinator	[JF: Do you have consultants that say "I want this nurse"?] No. That does not work here. There is no choice for any consultant. I decide who should do the case.
Cardiac ORs Clinical Coordinator	I am in charge of the whole cardiac theatre. It is my responsibility to make sure that all the cases are booked going through safely, make sure the equipment are fine, that all the staff are trained and with adequate knowledge, and all the safety

	checks. [...] 99% of the time I solve the problem my own, and may resort to a main theatre Matron.
Cardiac ORs Clinical Coordinator	We have our own cardiac recovery bay. One of the anesthetics, it can be the consultant or the registrar, and the cardiac registrar or surgical care practitioner will take the patient around, and they will handover the patient.
Cardiac ORs Clinical Coordinator	I would ask the consultant to talk to my staff and say what he expects from my scrub nurse. That will make a big difference. I don't want them to teach cardiac surgery. What do you expect from scrub nurse? That is what the nurses should learn. This is what already happens today. Consultants teach nurses what their expectations are.
Cardiac ORs Surgeon	I know who my team are. And I know whom my colleagues on that team are, and who my nurses are, and they know who I am. And in our area it should include recovery as well, because that is an integral part of our process, we have our own recovery area which is pressurized.
Cardiac ORs Surgeon	There is serious team work available in operating theatres, and if you allow that team to be a team, and you have it well led, great things can happen. That is a very characteristic feature.
Cardiac ORs Clinical Coordinator	Four months ago they started the theater Nurses Award. In March I got the Best Nurse Award.
Cardiac ORs Surgeon	It is all the other things about work. Are they going to be persistently abused and persistently late? No. Is there a shift system that accounts for that with a little late stagger to handle it? Are their training opportunities good? Are there opportunities for promotion good? Is this whole self worth element of the job. She looks after that. If you look after that then you can do this sort of thing.
Cardiac ORs Surgeon	I personally think our theatres should run from 7 in the morning to 9 at night, not necessarily with the same surgeon, you wouldn't fly a plane like that either, but we should maximize the use of the plant. [There is] lack of will. Lack of clear financial benefit to somebody.
Cardiac ORs Clinical Coordinator	I do reward my staff for work. I send them to international studies in training for new products in Switzerland and France. You don't need to pay anything because the companies usually provide for everything. I just provide them a study date and I do their clinical time to send them away.

Cardiac ORs Knowledge View

Interviewee	**Interview quote(s)**
Cardiac ORs Clinical Coordinator	When you get any staff the first week I teach them what I expect from them, what should be the attitude if you want to be a good cardiac nurse. [...] I make new staff think... first few weeks I do that... then automatically they brush their teeth every day morning... it is routine. I also give them lots of books to read... I don't want anybody sitting around. [...] I want you to familiarize yourself with the surroundings first... only after do you learn the equipment and cardiac surgery things. First you need to familiarize where things are, and that there are different color codes, etc. If you want to be a good scrub nurse you need a good foundation.
Cardiac ORs Clinical Coordinator	Some people say they only learn from seniors, that is not true, you can also learn from junior doctors, or junior nurses.
Cardiac ORs Clinical	The education system is very poor in this country.

Coordinator	
Cardiac ORs Clinical Coordinator	80% of the patients see the consultant before they are put to sleep.... But if not the consultant they will see the registrar.
Cardiac ORs Clinical Coordinator	I noticed that the first thing we needed to change in the staff was to change their attitude. They didn't have any idea of why they were here. They were just coming in, do a couple of cases, and then going home. That is what they though nursing was. That is not nursing. Anybody can do that. If I tell a monkey to do that it will do that. I don't need trained people to do that. Then I explained that that is not our role, we should have adequate knowledge and skills, everything.
Cardiac ORs Surgeon	This is typical of [Hospital ABC] because, there are possibly, and I say possibly because I only know of 3, there are possibly 5 groups trying to do the same thing in their own area at the same time and that is one of the big symptomatic things about [Hospital ABC], because several things follow from that. Lets just say that there are 3 groups all think that are doing the same thing... maybe in a different area... one that is a waste of duplication, because if there is knowledge, if there is learning, the soon you share it with the core, whatever... Then when it comes to implementation the output will be different... it might have the same objective but the output will look and feel different... so you end up then with 3 sections of the hospital having believed they improved something, having believed they have changed something, but the outcomes are totally different or significantly different. They are not able to pinpoint the outcomes of the changes because other things are changing around them.
Cardiac ORs Surgeon	A lot of things would tie together on that... If you saw my activity... if you saw my economic impact, you could see whether it is dipping up or dipping down... or you could say that you are a really good chap, or that you are not a really good chap... That does not happen
Cardiac ORs Surgeon	the nursing team... the scrub nurses... the operating nurses in the specialists areas have long experienced long understanding of that area and of that procedure. That doesn't trickle down... it is top down... because when you come as a trainee to that area, you get incorporated into that system... that works well
Cardiac ORs Clinical Coordinator	I teach them what is important about our profession. How we should look after our patients. How we will be safe to run our places? How efficient we should be? How do you get the skills and knowledge? How do you communicate among care givers and the patients?
Cardiac ORs Surgeon	I was massively in favor of the timeout. In our cardiac theatres we never do a case without the timeout. Full stop. [...] I have noted though when I go to other theatres occasionally, or work with other surgeons, it doesn't always happen and then I make a point of saying it. I haven't noticed in neuro, and I don't go down there often, but I go down there 3 or 4 times a year [...]they don't think it is necessary... its free independent state of neuro surgery.
Cardiac ORs Surgeon	There is no situation on a regular basis, and I am very keen on "regular", because if it is irregular it is usually problem based, something happened, so we all meet. And we either agree to fight over it, or to ignore it, or maybe to change it. [...]The reason I say we meet regularly is so that there are no tensions and no issues, and also so that relationships are built up in a formal environment, that carry over into the work day, so that when a problem arises at 10am on Tuesday, you already know and understand everybody, and it never gets to the heat that it should.

Cardiac ORs Surgeon	You must see that in the [leadership project] thing... you come up with a good idea... and people don't say "that is such a good idea, we are going to do that tomorrow". I doubt that they ever, ever, say that at [Hospital ABC]. They really say that if we are just nice to this girl [analyst from internal lean team] for a while she will go away like all the others and we can still do more or less what we want to do.
Cardiac ORs Surgeon	[Project X] is perceived as an instrument by the board... Where they appear and where they meet people... people meet people... people like them... and they see value unless they are completely disenchanted and depressed with what they are supposed to be working at... people liven up to it... You can say on the good side that they are putting little plots of improvement around the building... You might even say that they are just putting fires out around the building...
Cardiac ORs Surgeon	There are some surgeons that who are fast... there are some surgeons who are slow... there are some surgeons who are very good... and there are some who might not be so good... but they are not the same four groups. We have very slow surgeons who are very good with very good results. Should they be penalized for being slow? I am not so sure. Do their patients go home with less complications and less readmission? Possibly. [...] carving them [surgeons] into minutes that really isn't going to work.
Cardiac ORs Surgeon	What works well is knowledge. When you have a core of people who know the surgery... know the people... know what they are doing.

Cardiac ORs Information View

Interviewee	Interview quote(s)
Cardiac ORs Clinical Coordinator	Evening 4 o'clock I go check the list on what is happening the next day... I bring the copy of the list for my staff and tell them to prepare both theaters for next day's morning cases. [...]Still there might be a change during nighttime when I am not here. I come everyday at 6.30am to 6.45am to check. My duty starts at 7.30am but I will come much earlier. [...] Then I will see the final list in the morning.
Cardiac ORs Clinical Coordinator	Every Friday I get the list of patients to be operated the following week. The cardiac administrator [she is a secretary] sends me the list. [...]This information is sent to me via email on Friday. The registrar then fills out the daily list by hand and go and give it to the main theater reception by 3.30pm.
Cardiac ORs Clinical Coordinator	We don't have to get bits and pieces... we have what is called a procedure pack for each consultant... so just get the instruments and put them in the procedure pack. [...] Anybody can prepare the kit for the next day... usually they finish preparing the kit by 4.30 or 5 o'clock. They finish the shift at 5.30, so before they go home they make sure that both theaters are ready for the next day. And they prepare theater 1 just in case for emergency during the night.

d. Neuro ORs

Neuro ORs External / Policy View

Interviewee	Interview quote(s)
Neuro ORs Anesthesiologist	Unlike in the US where you can turn away somebody because you don't have time to operate them, here if someone gets referred to you by its GP you can't turn them away.
Neuro ORs	As you see the European Work Directives coming in... the amount of

Anesthesiologist	responsibility being pealed away... the amount of hours being pealed away... the night call being pealed away...
Neuro ORs Anesthesiologist	In neurosurgery we have set up systems which haven't necessarily improved efficiency but have made the process slightly more robust. So I wouldn't dream about doing a complicated spinal procedure without having a spinal surgeon standing next to me.
Neuro ORs Anesthesiologist	There has been small change in the way private insurance works for orthopedic surgeons... if you are an orthopedic surgeon and you do some spinal work your malpractice insurance goes up very substantially... so if you drop your small amount of spinal work in the private sector you pay much less. So over the last 3 years or so, many orthopedic surgeons have stopped doing spinal in the private sector. Within NHS work we are insured and we can do what we like... within reason within the hospital.
Neuro ORs Surgeon	It is a real problem with the way that training has changed... essentially the requirements for actual training time for trainees has increased, the hours that they are working have decreased, and decreasing further next year, so when I started as a registrar I was doing a 96 hour week on the residence in the hospital throughout. Now it is dropping down to 48 hours, and in fact when I started here as a trainee there were 6 trainees and now there are 11... there is the pressure of doing more cases with 18 weeks... there is no doubt that I do one of my standard procedures in about half the time my senior trainee takes... so they get much less time to do some

Neuro ORs Strategy View

Interviewee	Interview quote(s)
Neuro ORs Surgeon	Get simple patients through an infrastructure designed for complicated patients. We have assumed that all patients are massively complicated.
Neuro ORs Surgeon	there is the pressure of doing more cases with 18 weeks... there is no doubt that I do one of my standard procedures in about half the time my senior trainee takes... so they get much less time to do some

Neuro ORs Service View

Interviewee	Interview quote(s)
Neuro ORs Surgeon	There is some cultural thing here because you can't have the patient waiting outside the operating room because it is uncomfortable for the patient, which doesn't make any sense doing because patients are pretty much happy in waiting outside to have the operation. What that does is that it introduces an unpredictable amount of time for the patient to be sent... it is hard to predict how and that can lead to delays in theatres...
Neuro ORs Surgeon	there are a couple of cancellations in the same day a couple times a week
Neuro ORs Anesthesiologist	It is not only that you are missing a [18 week] target but it is also that somebody will come in months and months after they presented with symptoms and their symptoms have changed... maybe they have gotten worse or better... they are seen by a different surgeon who first assessed them...
Neuro ORs Surgeon	We continue to have some cancellations due to change in symptoms and that is partially due to the fact that we still have long waiting lists.
Neuro ORs Anesthesiologist	Blood drawing is a little chaotic... frequently patients will come to us and their second blood sample has not been done. Because the house officers are

	doing whatever they are doing they say they can't draw the sample, etc, so we'll have the anesthesiologist do it. Houseman does not do his job because it is too late, he is overworked, or had to go home, so the workload gets shifted to consultant
Neuro ORs Surgeon	You are on a 48 hour week, so two thirds of the time people are not here... The European Work Directive is such that the people doing the operations are not the same doing the morning round on the operated patients, and there are several times where the information is lost in terms of what is meant to be done for patient recovery. [...] That process does not work well... There aren't good, robust handover arrangements in place, and we would like to think that the nurses have them, but of course they don't either, because the information about the operation note said that Mr. Blog can get up today which never actually get into the patient notes.
Neuro ORs Surgeon	You don't get your demarcation lines which means that when neurosurgery gets referred a case from general medicine for an opinion we don't really want to go down there, and we don't talk to their physicians, they don't talk to us, and we don't care, and that is the mentality that is setup by not having any cross specialty talk. You have the same difficulty within neuroscience, neurology, and neurosurgery, almost the same specialty really becomes pulled apart mostly because we operate on different days, there is no discussion, so we end up with curt referrals by fax and it doesn't work well.

Neuro ORs Process View

Interviewee	**Interview quote(s)**
Neuro ORs Surgeon	Things seem to go surprisingly wrong sometimes... you think if you would have the same list and cases all the time that they would have enough kit, operating equipment, and stuff like that, but sometimes you will find that some things are missing, and that things are disorganized
Neuro ORs Anesthesiologist	Blood drawing is a little chaotic... frequently patients will come to us and their second blood sample has not been done. Because the house officers are doing whatever they are doing they say they can't draw the sample, etc, so we'll have the anesthesiologist do it. Houseman does not do his job because it is too late, he is overworked, or had to go home, so the workload gets shifted to consultant
Neuro ORs Surgeon	You are on a 48 hour week, so two thirds of the time people are not here... The European Work Directive is such that the people doing the operations are not the same doing the morning round on the operated patients, and there are several times where the information is lost in terms of what is meant to be done for patient recovery. [...] That process does not work well... There aren't good, robust handover arrangements in place, and we would like to think that the nurses have them, but of course they don't either because the information about the operation note said that Mr. Blog can get up today which never actually get into the patient notes.
Neuro ORs Anesthesiologist	The nursing staff at [Hospital ABC]work really hard, they are understaffed and under trained, they get confused, they don't seem to run terribly smoothly as they are inconsistent from one ward to the other.

Neuro ORs Organization View

Interviewee	**Interview quote(s)**
Neuro ORs	nurses are working way over time... we have completely filled our lists as best

Anesthesiologist	we can...
Neuro ORs Surgeon	The difficulty with management is that it is massively time consuming... I feel that I have to make a choice... Either you are a clinician or you are one of them... there is no halfway house... and I am struggling with that at the moment because I went into medicine to become a surgeon not a manager... and yet I think there is a requirement for clinical leadership.
Neuro ORs Anesthesiologist	The dual management system between the upper business management group and the clinical management group. In the US there is a lot more cross over between the two, whereas here you step out of one into the other
Neuro ORs Surgeon	Neuroscience purchases the theater slot from Critical Care, and the cost of that includes the cost of the anesthetic agent, and that sort of thing. If we don't use it, they save money, we of course don't generate any income because we are not putting patients through it, so of course we lose money. [...]The failure of having one group with a single success criteria will interfere always with the way theatres are run.
Neuro ORs Surgeon	The adverse feature here is that we have very different management structures and I think that it a real central problem in theatres, in that, in order to get a patient to theater we need ward staff, we need porters, we need some sort of reception process in theatres, we need theater nurses, we need theater ODAs, we need anesthesiologists and we need a surgeon. All of those have completely separate management structures. So if there is a problem with the interface between the porters and the theatre reception, I could do nothing about it without going up my management structure, across to theirs, and then down again. So there is almost no way of dealing with these cross role problems.
Neuro ORs Surgeon	To improve the communication between the ward and the theatres I think the care group manager should be in the field more and they should let people on the wards get a sense that there is somebody directing other than the person that is one level above them
Neuro ORs Surgeon	There is more specialization of anesthesiologists in cardiac and so they are more wedded to cardiac as I understand it, whereas many of our anesthesiologists are also orthopedic, or gynecology, or whatever, so while they do one or two neuro sessions a week they will do three or four other sessions.
Neuro ORs Anesthesiologist	I think there is a level playing field across theatres because there doesn't seem to be a tremendous hierarchy like there is in the US. In the UK the surgeons are in the same salary scale as the anesthesiologists, nobody is paid by the case unless there is private ones. [...] People are in a level playing field so that helps in the interaction between the surgeons and the anesthesiologists.
Neuro ORs Surgeon	[In our own neuro theatres] we have the flexibility of late finishes because it is a small group. We are not going to overrun multiple theatres but if one theatre ones to overrun it is okay to do that. The general feeling is that we are all on the same side
Neuro ORs Surgeon	It has been interesting to see how poor theatre utilization has been up there... we are averaging 1.8 cases for all day lists there, compared with about 2.6 cases in the downstairs theatres, and even more so that upstairs has a simpler case mix, so it is extremely poor usage.
Neuro ORs Surgeon	We have been given additional theater capacity because we don't have enough capacity, in one of the other general theatres and that works disastrously

	poorly for a whole variety of reasons. First of all nobody [from our team] wanted to work there from our point of view outside our comfort zone, so there is a lack of enthusiasm about it.
Neuro ORs Anesthesiologist	in the UK you are taken back to an old surgeon anesthesiologist relationship, you are assigned a fixed session, on a fixed day, to a fixed surgeon, to do a fixed list, therefore your experience to theatres in general is actually limited to your one list which you do every week and every day
Neuro ORs Surgeon	I would measure the number of cases in the year or in the month... I think that is a very easy one... and that would be very effective. [...] I think profit sharing arrangements would work well.
Neuro ORs Anesthesiologist	I hate to say it but this relates to the people whom I have come across, certainly at consultant level here, and it is almost uniquely financially driven. They will do it for the money [...][If we say] we have targets and we are falling short of the targets, we have to look better in terms of clinical care, there is no interest... [then] they will give 850 pounds a day if you work, right on board.... It is unbelievable...
Neuro ORs Surgeon	Operations was very clearly their [Arizona hospital he visited] unit of currency, the more operations the more money, and everything was designed around that. I think we struggle slightly in what our unit of currency is.
Neuro ORs Surgeon	There is no consultant sitting room which sounds very elitist, and it is not really how the Trust likes to view itself which is why it was closed down and has not been reinstituted across specialties, which means that there is no discussion across specialties, and that is undoubtedly a big problem in this hospital.

Neuro ORs Knowledge View

Interviewee	**Interview quote(s)**
Neuro ORs Anesthesiologist	As you see the European Work Directives coming in... the amount of responsibility being pealed away... the amount of hours being pealed away... the night call being pealed away... the concern of the faculty here is that they are being deskilled or in some sense detrained... There is a general feeling that they are getting fewer hours on the ground and that when they get into the positions of responsibility they won't quite have the same degree of experience when they get out the other end.
Neuro ORs Surgeon	It is a real problem with the way that training has changed... essentially the requirements for actual training time for trainees has increased, the hours that they are working have decreased, and decreasing further next year, so when I started as a registrar I was doing a 96 hour week on the residence in the hospital throughout. Now it is dropping down to 48 hours, and in fact when I started here as a trainee there were 6 trainees and now there are 11... there is the pressure of doing more cases with 18 weeks... there is no doubt that I do one of my standard procedures in about half the time my senior trainee takes... so they get much less time to do some.
Neuro ORs Anesthesiologist	Keep everybody working, keep everybody in the OR, and I think that is not a good thing in medicine.
Neuro ORs Anesthesiologist	They will do it for the money. If I were to say that we need to start a journal club so that everybody can keep up to date, there is absolutely no interest.
Neuro ORs Surgeon	I think we could work better with things like avoiding wrong side surgery or operating on the wrong side of the head. We have a system which is not very robust to deal with that. We have a case like that at least once a year.

Neuro ORs Information View

Interviewee	Interview quote(s)
Neuro ORs Surgeon	"The key is the availability of the appropriate information at the bedside. That operation note exists and is filed in a set of notes like this [picks up big paper medical record]... there they are, patient came back from theater, volume one, so probably the operation note is in volume two which is somewhere else [inquisitive voice]. But lets find an operation note here... hopefully... there it is... ah! Nothing written on it!!!!"
Neuro ORs Surgeon	You are on a 48 hour week, so two thirds of the time people are not here... The European Work Directive is such that the people doing the operations are not the same doing the morning round on the operated patients, and there are several times where the information is lost in terms of what is meant to be done for patient recovery. [...] That process does not work well... There aren't good, robust handover arrangements in place, and we would like to think that the nurses have them, but of course they don't either because the information about the operation note said that Mr. Blog can get up today which never actually get into the patient notes.
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Neuro ORs Surgeon	when neurosurgery gets referred a case from general medicine for an opinion we don't really want to go down there, and we don't talk to their physicians, they don't talk to us, and we don't care, and that is the mentality that is setup by not having any cross specialty talk. You have the same difficulty within neuroscience, neurology, and neurosurgery, almost the same specialty really becomes pulled apart mostly because we operate on different days, there is no discussion, so we end up with curt referrals by fax and it doesn't work well.

ii. Performance Scorecard Data

The following figure was captured from Hospital ABC's Performance Scorecard and includes data specifically pertaining to the highest and lowest performing ORs, as well as the Main ORs which represented the initial service unit of interest for exploratory research.

	Metric	Units	Surg & CC	Neuro	Cardiac
Quality of care	Average Length of Stay				
	Elective	Days			
	Non - Elective	Days			
	New to Follow Up Ratio (YTD)	Ratio			
	Readmissions (within 14 days)	%			
	Infection Control (YTD)	Cases			
Patient Experience	How are we doing?	%			
	Care Perceptions	%			
	Patient Engagement	%			
	Environment	%			
	Timely response to complaints	%			
	Admitted Patients Treated < 18 weeks	%			
	Non-Admitted Patients Treated < 18 weeks	%			
Financial and Operational Efficiency	Financial Contribution (YTD)	£			
	Income (YTD)	£			
	Expenditure (YTD)	£			
	Activity - Electives (YTD)	Spells			
	Emergency Inpatients (YTD)	Spells			
	Non-Elective Inpatients (YTD)	Spells			
	Outpatient Attendances (YTD)	Number			
	Bed Utilisation Rate	%			
	Theatre Utilisation Rate	%			
	28 Day Cancellation Rule	Number			
	DNA Rate	%			
	Coding Depth	Ratio			
	Data Quality - Inpatients	%			
	Outpatients	%			
Staff	Sickness and absence	%			